

**ENVIRONMENTAL PROTECTION
AGENCY**
40 CFR Part 82

[EPA-HQ-OAR-2023-0043; FRL-10125-02-OAR]

RIN 2060-AV77

**Protection of Stratospheric Ozone:
Listing of Substitutes Under the
Significant New Alternatives Policy
Program in Commercial and Industrial
Refrigeration**

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: Pursuant to the U.S. Environmental Protection Agency's Significant New Alternatives Policy program, this action lists several substitutes as acceptable, subject to use conditions, for retail food refrigeration, commercial ice machines, industrial process refrigeration, cold storage warehouses, and ice skating rinks. Through this action, EPA is incorporating by reference standards which establish requirements for commercial refrigerating appliances and commercial ice machines, safe use of flammable refrigerants, and safe design, construction, installation, and operation of refrigeration systems. This action also exempts propane, in the refrigerated food processing and dispensing end-use, from the prohibition under the Clean Air Act (CAA) on knowingly venting, releasing, or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration, as the Administrator is determining, on the basis of existing evidence, that such venting, release, or disposal of this substance in this end-use does not pose a threat to the environment.

DATES: This rule is effective July 15, 2024. The incorporation by reference of certain material listed in the rule is approved by the Director of the Federal Register as of July 15, 2024. The incorporation by reference of certain other material listed in the rule was approved by the Director of the Federal Register as of February 21, 2012 (76 FR 78832), May 11, 2015 (79 FR 19454), and January 3, 2017 (81 FR 86778).

ADDRESSES: EPA has established a docket for this action under Docket ID No. EPA-HQ-OAR-2023-0043. All documents in the docket are listed on the <https://www.regulations.gov> website. Although listed in the index, some information is not publicly available, e.g., Confidential Business

Information (CBI) or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the internet and will be publicly available only in hard copy form. Publicly available docket materials are available electronically through <https://www.regulations.gov> or in hard copy at the Air and Radiation Docket, EPA/DC, EPA West, Room 3334, 1301 Constitution Avenue NW, Washington, DC 20460. The Docket Center's hours of operations are 8:30 a.m.–4:30 p.m., Monday–Friday (except Federal Holidays). For further information on EPA Docket Center services and the current status, please visit <https://www.epa.gov/dockets>.

FOR FURTHER INFORMATION CONTACT: Perrin Krisko, Stratospheric Protection Division, Office of Atmospheric Protection (Mail Code 6205A), Environmental Protection Agency, 1200 Pennsylvania Ave. NW, Washington, DC 20460; telephone number: 202-564-2328; email address: krisko.claudia@epa.gov. Notices and rulemakings under EPA's Significant New Alternatives Policy (SNAP) program are available on EPA's SNAP website at <https://www.epa.gov/snap/snap-regulations>.

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I. General information

A. Executive Summary and Background

EPA is finalizing new and revised listings after its evaluation of human health and environmental information for these substitutes under the Significant New Alternatives Policy (SNAP) program. The Agency is finalizing action on new and revised listings in the refrigeration and air conditioning (AC) sector based on the information that EPA has included in the docket. This final action provides new refrigerant options, thereby increasing flexibility for industry, in specific uses.

This action lists new alternatives for the refrigeration and AC sector.

Specifically, EPA is:

- Listing hydrofluoroolefin (HFO)-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new retail food refrigeration equipment (*i.e.*, stand-alone units, remote condensing units, supermarket systems, and refrigerated food processing and dispensing equipment);
 - Listing R-454A as acceptable, subject to use conditions, for use in new remote condensing units and supermarket systems;
 - Listing R-290 (propane) as acceptable, subject to use conditions, for use in new refrigerated food processing and dispensing equipment and revising the existing use conditions for R-290 in new stand-alone units.
 - Listing HFO-1234yf, R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new commercial ice machines;
 - Listing hydrofluorocarbon (HFC)-32, R-454A, and R-454B as acceptable, subject to use conditions, for use in new commercial ice machines with a remote compressor, for batch-type self-contained automatic commercial ice machines with a harvest rate above 1,000 lb ice per 24 hours, and for continuous type self-contained automatic commercial ice machines with a harvest rate above 1,200 lb ice per 24 hours;
 - Revising the existing use conditions for R-290 for use in new self-contained commercial ice machines;
 - Listing HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new equipment for industrial process refrigeration (IPR), including chillers and direct expansion IPR equipment;
 - Listing HFC-32, R-454A, and R-454B as acceptable, subject to use conditions, for use in new equipment for IPR, including chillers and direct expansion IPR equipment where the temperature of the refrigerant entering the evaporator is less than or equal to -30°C (-22°F);
 - Listing HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new cold storage warehouses; and
 - Listing HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new ice skating rinks with a remote compressor.
- In general, the final use conditions are consistent across the various substitutes and end-uses contained in this final

rule. Because of this similarity, EPA discusses the final use conditions that apply to retail food refrigeration, commercial ice machines, industrial process refrigeration, cold storage warehouses, and ice skating rinks in section II.H of this preamble. In summary, the common use conditions are:

(1) These refrigerants may be used only in new equipment, designed specifically and clearly identified for use with the refrigerant. None of these listings provide for use of the substitutes in a conversion or “retrofit” refrigerant for existing equipment.

(2) These refrigerants may be used in equipment that a) is consistent with the requirements listed in the 2nd edition (dated October 27, 2021) of UL¹ Standard 60335–2–89, “Household and Similar Electrical Appliances—Safety—Part 2–89: Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor” (hereafter “UL 60335–2–89,” which refers to the 2nd edition of UL 60335–2–89 unless otherwise stated), and b) is installed consistent with the requirements of ASHRAE 15–2022, “Safety Standard for Refrigerating Systems.” For equipment outside the scope of UL 60335–2–89, as described later in this document, or that is located in industrial occupancies as defined in ASHRAE 15–2022, refrigerants listed herein must be used in equipment that is installed in a manner consistent with ASHRAE 15–2022. For R–290, which already has listings that incorporate by reference earlier UL standards, EPA is providing a transition period when equipment may meet either the earlier UL standard or UL 60335–2–89. Stand-alone units or self-contained commercial ice machines using R–290 that are unchanged, except for cosmetic changes, from the model or design that was previously certified to the UL 471 (10th edition) or UL 563 standard (8th edition) may continue to be manufactured consistent with those standards.

(3) These refrigerants must be used with warning labels on the equipment and packaging that are similar to or match verbatim those required by UL 60335–2–89.²

(4) Equipment must be marked with distinguishing red color-coded hoses and piping to indicate use of a flammable refrigerant and marked

service ports, pipes, hoses, and other devices through which the refrigerant is serviced.

(5) Equipment must be marked with one or more flammability warning symbols—either that in Clause 7.6DV D1 of UL 60335–2–89, 2nd edition; that in Annex 1 to Globally Harmonized System of Classification and Labelling of Chemicals (GHS), 9th edition, for hazard category 1 flammable gases; or marked with both symbols.

Additional use conditions specific to particular end-uses may also apply and are discussed with each final listing. The regulatory text of the final listings, including the final use conditions and further information, appears in tables at the end of this document. The final listings will appear in appendix Y to 40 Code of Federal Regulations (CFR) part 82, subpart G. The final revised listings for R–290 in new retail food refrigeration equipment (stand-alone units only) and in new self-contained commercial ice machines will appear, respectively, in appendices R and V to 40 CFR part 82, subpart G.

There may be other legal obligations pertaining to the manufacture, use, handling, and disposal of the listed substitutes that are not included in the information in the tables (*e.g.*, the CAA section 608(c)(2) venting prohibition or U.S. Department of Transportation (DOT) requirements for transport of flammable gases). Flammable refrigerants being recovered or otherwise disposed of from commercial or industrial refrigeration equipment are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270). In addition, EPA issued a final Technology Transitions Rule under subsection (i) of the American Innovation and Manufacturing Act of 2020 (hereafter referred to as “the AIM Act”) (88 FR 73098; October 24, 2023;). Under that rule, EPA restricts the use of many HFC refrigerants in a variety of subsectors within the Refrigeration, Air Conditioning, and Heat Pumps sector, including in technologies covered by this final SNAP rule.³ Throughout this document, EPA notes relevant restrictions on refrigerants under the final Technology Transitions Rule. In finalizing the listing decisions in this rulemaking, EPA is cognizant of the restrictions established under the Technology Transitions Rule. This is because the listings in this SNAP rule are generally intended to expand the

universe of available options in certain end-uses. EPA recognizes that there could be situations where there would be little practical value in listing alternatives acceptable under SNAP that cannot legally be used in a particular end-use due to restrictions under Technology Transitions Rule, and this consideration could be particularly pronounced with respect to those alternatives that would be subject to restrictions under the Technology Transitions Rule in the near future (*e.g.*, as of January 1, 2025). However, the SNAP and Technology Transitions programs are established under different legal authorities and use separate frameworks for making decisions. Substitutes that are listed as acceptable, acceptable subject to use conditions, acceptable subject to narrowed use limits, or unacceptable under the SNAP program are evaluated through a comparative risk framework that considers the overall risk posed to human health and the environment for specific end-uses. In evaluating the substitutes listed in this rule, EPA has considered whether they present risks that are lower than or comparable to risks from other substitutes that are currently or potentially available in the end-uses under consideration, consistent with its approach under SNAP.

In addition, EPA is exempting R–290 used in the refrigerated food processing and dispensing end-use from the prohibition under CAA section 608(c)(2) on knowingly venting, releasing, or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration, as the Administrator is determining, on the basis of current evidence described later in this preamble, that such venting, release, or disposal of this substance in this end-use does not pose a threat to the environment. This exemption is being finalized in the regulations under CAA section 608 at 40 CFR 82.154(a)(1), which addresses the statutory prohibition and exemptions from it.

SNAP Program Background

The SNAP program implements CAA section 612. Several 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, and chlorobromomethane) or class II (hydrochlorofluorocarbon (HCFC))

¹ UL, formerly known as Underwriters Laboratories.

² Or for equipment using R–290 following the requirements of UL 471 or UL 563, they must use the warning labels required in those listings, which match those required by those standards.

³ End-uses under SNAP are included in the similar concept of subsectors defined in the Technology Transitions Rule (88 FR 73098, October 24, 2023).

ozone-depleting substance (ODS) 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.

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).

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 a new or existing chemical is introduced into interstate commerce for significant new use as a substitute for a class I substance. The producer must also provide the Agency with the producer's published or unpublished health and safety studies on such substitutes.

The regulations for the SNAP program are promulgated at 40 CFR part 82, subpart G, and the Agency's process for reviewing SNAP submissions is described in regulations at 40 CFR 82.180. Under these rules, the Agency has identified five types of listing decisions: acceptable; acceptable subject to use conditions; acceptable subject to narrowed use limits; unacceptable; and pending (40 CFR 82.180(b)). Use conditions and narrowed use limits are both considered "use restrictions." Substitutes that are deemed acceptable with no use restrictions (no use conditions or narrowed use limits) can be used for all applications within the relevant end-uses in the sector. 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 minimize risks to human health and the environment. EPA describes such substitutes as "acceptable subject to use conditions" (40 CFR 82.180(b)(2)). For some substitutes, the Agency may permit a narrowed 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. EPA describes these substitutes as "acceptable subject to narrowed use limits." Under the narrowed use limit, users intending to adopt these substitutes "must ascertain that other alternatives are not technically feasible" (40 CFR 82.180(b)(3)).

In making decisions regarding whether a substitute is acceptable or unacceptable, and whether substitutes present risks that are lower than or comparable to risks from other substitutes that are currently or potentially available in the end-uses under consideration, EPA examines the following criteria in 40 CFR 82.180(a)(7): (i) atmospheric effects and related health and environmental impacts; (ii) general population risks from ambient exposure to compounds with direct toxicity and to increased ground-level ozone; (iii) ecosystem risks; (iv) occupational risks; (v) consumer risks; (vi) flammability; and (vii) cost and availability of the 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 under SNAP, these statements are not binding for use of the substitute under the SNAP program. However, statutory and regulatory requirements so listed are binding under other authorities (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.

For additional information on the SNAP program, visit the SNAP website at <https://www.epa.gov/snap>. The full lists of acceptable substitutes for ODS in all industrial sectors are available at <https://www.epa.gov/snap/snap-substitutes-sector>. 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. SNAP decisions and the appropriate **Federal Register** citations can be found at <https://www.epa.gov/snap/snap-regulations>. Substitutes listed as unacceptable; acceptable, subject to narrowed use limits; or acceptable, subject to use conditions, are also listed in the appendices to 40 CFR part 82, subpart G.

Background on Requirements Concerning Venting, Release, or Disposal of ODS and Substitute Refrigerants Under CAA Section 608

The statutory requirements concerning venting, release, or disposal of ODS refrigerants and substitutes for ODS used as refrigerants 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 IPR.⁴ 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)(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 refrigerant 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 used as refrigerants and their substitutes, which we also refer to as the "venting prohibition" in this final

⁴ Additional information about the 608 Refrigerant Management Program is available in EPA's rules implementing that program, such as rules published on May 14, 1993 (58 FR 28660), November 18, 2016 (81 FR 82272), and March 11, 2020 (85 FR 14150).

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.

EPA has established regulations clarifying how the venting prohibition in section 608(c) applies to ODS and substitute (e.g., HFCs and perfluorocarbons (PFCs)) refrigerants. 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 an appliance or industrial process refrigeration may knowingly vent or otherwise release into the environment any refrigerant (including substitute refrigerants) from such appliances or industrial process refrigeration, with the exception of certain specified substitutes in the specified end-uses, as provided in 40 CFR 82.154(a).

EPA has exempted from the venting prohibition several hydrocarbon (HC) refrigerant substitutes, including R-290, in specific end-uses where the Agency also listed the substitutes as acceptable, subject to use conditions, under the SNAP program. See, for example, EPA's regulations issued May 23, 2014 (79 FR 29682), April 10, 2015 (80 FR 19453), and December 1, 2016 (81 FR 86778).⁵ Those regulatory exemptions do not apply to blends of hydrocarbons (HCs) with other refrigerants or containing any amount of any CFC, HCFC, HFC, or PFC. The exemptions for R-290 by end-use are codified at 40 CFR 82.154(a)(1)(viii).

In establishing those exemptions, 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. See, e.g., 81 FR 86778, December 1, 2016. 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 saturated HC refrigerant substitutes.

B. Does this action apply to me?

The following list identifies regulated entities that may be affected by this rule and their respective North American Industrial Classification System (NAICS) codes:

- Plumbing, Heating, and Air Conditioning Contractors (NAICS 238220)
- All Other Basic Organic Chemical Manufacturing (NAICS 325199)
- Air Conditioning and Warm Air Heating Equipment and Commercial and Industrial Refrigeration Equipment Manufacturing (NAICS 333415)
- Refrigeration Equipment and Supplies Merchant Wholesalers (NAICS 423740)
- Recyclable Material Merchant Wholesalers (NAICS 423930)
- Supermarkets and Other Grocery (except Convenience) Stores (NAICS 445110)
- Convenience Stores (NAICS 445120)
- Limited-Service Restaurants (NAICS 722211)
- Appliance Repair and Maintenance (NAICS 811412)

This list is not intended to be exhaustive, but rather to provide a guide for readers regarding entities likely to be affected by this action. To determine whether your facility, company, business, or organization could be affected by this action, you should carefully examine the regulations at 40 CFR part 82, subpart G, and these revisions. 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?

The following acronyms and abbreviations are used in the preamble of this document:

AC—Air Conditioning
 AEL—Acceptable Exposure Limit
 AIHA—American Industrial Hygiene Association
 AIM Act—American Innovation and Manufacturing Act of 2020
 ANSI—American National Standards Institute
 ASHRAE—American Society of Heating, Refrigerating and Air-Conditioning Engineers
 ASTM—American Society for Testing and Materials
 ATEL—Acute Toxicity Exposure Limit
 CAA—Clean Air Act
 CAS Reg. No.—Chemical Abstracts Service Registry Identification Number
 CBI—Confidential Business Information

CFC—Chlorofluorocarbon
 CFR—Code of Federal Regulations
 CO₂—Carbon Dioxide
 DOE—United States Department of Energy
 DOT—United States Department of Transportation
 DX—Direct Expansion
 EEAP—Environmental Effects Assessment Panel
 EPA—United States Environmental Protection Agency
 FR—Federal Register
 GHS—Globally Harmonized System of Classification and Labeling of Chemicals
 GWP—Global Warming Potential
 HC—Hydrocarbon
 HCFC—Hydrochlorofluorocarbon
 HCFO—Hydrochlorofluoroolefin
 HFC—Hydrofluorocarbon
 HFO—Hydrofluoroolefin
 HP—Heat Pump
 IBC—International Building Code
 ICC—International Code Council
 ICF—ICF International, Inc.
 IEC—International Electrotechnical Commission
 IIAR—International Institute of Ammonia Refrigeration
 IPCC—Intergovernmental Panel on Climate Change
 IPR—Industrial Process Refrigeration
 ISO—International Organization for Standardization
 LFL—Lower Flammability Limit
 MIR—Maximum Incremental Reactivity
 NAAQS—National Ambient Air Quality Standards
 NAICS—North American Industrial Classification System
 NARA—National Archives and Records Administration
 NFPA—National Fire Protection Association
 ODP—Ozone Depletion Potential
 ODS—Ozone-Depleting Substances
 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
 ppm—Parts Per Million
 PRA—Paperwork Reduction Act
 RAL—“Reichs-Ausschuß für Lieferbedingungen und Gütesicherung” Germany's National Commission for Delivery Terms and Quality Assurance
 RCRA—Resource Conservation and Recovery Act
 RFA—Regulatory Flexibility Act
 SDS—Safety Data Sheet
 SIP—State Implementation Plan
 TLV—Threshold Limit Value
 TSCA—Toxic Substances Control Act
 TWA—Time Weighted Average
 UL—UL, formerly known as Underwriters Laboratories, Inc.
 UMRA—Unfunded Mandates Reform Act
 VOC—Volatile Organic Compound, Volatile Organic Compounds
 WEEL—Workplace Environmental Exposure Limit
 WMO—World Meteorological Organization

⁵ The United States Court of Appeals for the District of Columbia Circuit (“the court”) issued a partial vacatur of the December 1, 2016, rule “to the extent” it required manufacturers to replace already lawfully installed HFC substitutes.” See *Mexichem Fluor, Inc. v. EPA*, Judgment, Case No. 17–1024 (D.C. Cir., April 5, 2019), 760 Fed. Appx. 6 (Mem). The court's decision on the December 1, 2016, rule did not affect the portion of that rule that exempted certain HC refrigerant substitutes from the venting prohibition. This final rule is not EPA's response to the court's decision.

II. What is the Environmental Protection Agency (EPA) finalizing in this action?

This section of the preamble describes EPA's final listings for certain refrigerants in specific end-uses, including final use restrictions. In addition, this section provides responses to comments EPA received on the proposed listings during the public comment period for the proposed rule (May 24, 2023). The regulatory text for new listings is codified in appendix Y of 40 CFR part 82, subpart G. The regulatory text for two revised listings is codified in appendices R and V of 40 CFR part 82, subpart G. The final regulatory text contains listing decisions for the end-uses discussed throughout this section.

A. Retail Food Refrigeration—Listing of HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as Acceptable, Subject to Use Conditions, for Use in New Stand-Alone Units, Remote Condensing Units, Supermarket Systems, and Refrigerated Food Processing and Dispensing Equipment and Listing of R-454A as Acceptable, Subject to Use Conditions, for Use in New Remote Condensing Units and Supermarket Systems

This final rule lists HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in all end-use categories under retail food refrigeration (*i.e.*, stand-alone units, remote condensing units, supermarket systems, and refrigerated food processing and dispensing equipment). EPA is also listing R-454A as acceptable, subject to use conditions, for use in two end-use categories under retail food refrigeration (remote condensing units and supermarket systems). After consideration and evaluation of comments, EPA is finalizing the listings for HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A in all end-use categories under retail food refrigeration and R-454A in two end-use categories under retail food refrigeration as proposed.

EPA is finalizing several use conditions for these end-use categories that are in common with those finalized for other end-uses (retail food refrigeration, commercial ice machines, IPR, cold storage warehouses, and ice skating rinks with a remote compressor) discussed elsewhere in this final rule. Because of this similarity, EPA discusses the use conditions that apply to all five end-uses in detail in section II.H of this preamble. Briefly

summarized, the common use conditions that EPA is finalizing are: restricting the use of each refrigerant to new equipment that is specifically designed and clearly marked for that refrigerant; use consistent with ASHRAE 15-2022 and with UL 60335-2-89 (with certain exceptions),⁶ including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings.

For use of these substitutes in retail food refrigeration equipment, EPA is also finalizing the use condition that these refrigerants may only be used in commercial refrigeration equipment that meets the requirements listed in the American National Standards Institute (ANSI)/American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 15-2022 "Safety Standard for Refrigeration Systems" (hereafter "ASHRAE 15-2022"). In cases where the final rule includes requirements that are different than those of ASHRAE 15-2022, EPA is finalizing that the appliance needs to meet the requirements of this rule in addition to the requirements in ASHRAE 15-2022. This additional use condition is discussed further in section II.A.4 of this preamble.

For R-454A in supermarkets and remote condensing units, EPA is finalizing an additional use condition that this substitute may only be used in equipment with a refrigerant charge capacity less than 200 pounds or in the high-temperature side of a cascade system.

1. Background on Retail Food Refrigeration

Retail food refrigeration, an end-use within the SNAP program, encompasses the equipment used for storing and displaying (generally for sale) food and beverages at different temperatures necessary for the different products (*e.g.*, chilled and frozen food). The designs and refrigerating capacities of equipment vary widely to ensure the proper temperatures are achieved and maintained.

Retail food refrigeration is composed of four categories of equipment: stand-alone units; refrigerated food processing

and dispensing equipment; remote condensing units; and supermarket systems. EPA treats each of these four end-use categories as a separate end-use for purposes of our evaluations of the overall risk to human health and the environment compared to other refrigerants that are available or potentially available for the same end-use and for purposes of listing substitute refrigerants.

Stand-alone units are refrigerators, freezers, and reach-in coolers (either open or with doors) where all refrigeration components are integrated and, for the smallest types, the refrigerant circuit is entirely brazed, welded, or uses threaded fittings. These systems are charged with refrigerant at the factory and typically require only an electricity supply to begin operation. Such systems are used to chill and temporarily store perishable items for commercial sale, such as beverages and food.

As the name suggests, refrigerated food processing and dispensing equipment dispenses, typically through a nozzle, and often processes a variety of food and beverage products. For instance, 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 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 for melting or dislodging ice, or for sanitation purposes.

Refrigerated food processing and dispensing equipment can be self-contained or can be connected via piping to a dedicated condensing unit located elsewhere. Equipment within this end-use category includes but is not limited to refrigerated equipment used to process and dispense beverages and food such as: 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.

Remote condensing units typically have refrigerating capacities ranging from 1kW to 20kW (0.3 to 5.7 refrigeration tons). They are composed of one (and sometimes two) compressor(s), one condenser, and one receiver assembled into a single unit, which is normally located external to the sales area. This equipment is

⁶ Exceptions include equipment that is outside the scope of UL 60335-2-89, such as commercial refrigeration products with rated voltage of 15,000 V or greater, appliances using flammable refrigerant in transcritical refrigeration systems, vending machines, and professional ice-cream appliances. In addition, for equipment installed in situations where that standard refers to 'national standards,' refrigerants may be used in equipment installed consistent with the requirements of ASHRAE 15-2022 without meeting the requirements of UL 60335-2-89.

connected to one or more nearby evaporator(s) used to cool food and beverages stored in display cases and/or walk-in storage rooms. Remote condensing units are commonly installed in convenience stores and specialty shops such as bakeries and butcher shops.

Typical supermarket systems are also known as multiplex or centralized systems. They operate with racks of compressors installed in a machinery room; different compressors turn on to match the refrigeration load necessary to maintain temperatures. Two main design classifications are used: direct and indirect systems. In the United States, direct systems are the most widespread. The majority of supermarkets in the United States use centralized direct expansion (DX) systems to cool their display cases.⁷ The refrigerant circulates from the machinery room to the sales area, where it evaporates in display-case heat exchangers, and then returns in vapor phase to the suction headers of the compressor racks. The supermarket walk-in cold rooms are often integrated into the system and cooled similarly, but an alternative option is to provide a dedicated condensing unit for a given storage room. Another type of supermarket design, often referred to as a distributed refrigeration system, uses an array of separate compressor racks located near the display cases rather than having a central compressor rack system. Each of these smaller racks handles a portion of the supermarket load, with five to ten such systems in a store.

Indirect supermarket system designs include secondary loop systems and cascade refrigeration. Indirect systems use a chiller⁸ or other refrigeration system to cool a secondary fluid that is often circulated throughout the store to the cases. Examples of secondary fluids include water, brine, propylene glycol, air, and carbon dioxide (CO₂). Compact chiller versions of an indirect system

rely on a lineup of ten to 20 units, each using small charge sizes. As the refrigeration load changes, more or fewer of the chillers are active. Compact chillers are used in a secondary loop system whereby the chillers cool a secondary fluid that is then circulated throughout the store to the display cases. Each compact chiller is an independent unit with its own refrigerant charge, reducing the potential for refrigerant to be released from leaks or for a catastrophic failure. Cascade systems use a compressor to raise the low-temperature, secondary fluid from low-temperature conditions up to an intermediate temperature while a separate, primary refrigerant system uses a different, higher temperature refrigerant to condense the secondary fluid. Each system within the cascade design contains its own refrigerant charge, allowing the use of different refrigerants in each system. This application has generally used a lower global warming potential (GWP) refrigerant, specifically CO₂ (R-744), in the low-temperature system, with a variety of refrigerants in the high-temperature system.

Refrigerant choice may depend on the refrigerant charge size of the equipment, desired temperature, system performance, energy efficiency, and health, safety and environmental considerations, and cost among other things. In addition to regulations pursuant to the SNAP program and the AIM Act, other Federal or local regulations may also affect refrigerant choice. For instance, regulations from OSHA may restrict or place requirements on the use of some refrigerants, such as ammonia (R-717). Building codes from local and State agencies may also incorporate limits on the types and amounts of particular refrigerants used.

2. What are the ASHRAE classifications for refrigerant flammability?

The ANSI/ASHRAE Standard 34-2022 “Designation and Safety Classification of Refrigerants” (hereafter “ASHRAE 34-2022”) assigns a safety group classification for each refrigerant which consists of two to three alphanumeric characters (*e.g.*, A2L or

B1). The initial 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 threshold limit value-time-weighted average (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, 2L, or 3. Tests for flammability are conducted in accordance with American Society for Testing and Materials (ASTM) E681 using a spark ignition source at 140 °F (60 °C) and 14.7 psia (101.3 kPa).⁹ 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 (8,169 Btu/lb), and have a lower flammability limit (LFL) greater than 0.10 kg/m³. The flammability classification “2L” is given to refrigerants that, when tested, exhibit flame propagation, have a heat of combustion less than 19,000 kJ/kg (8,169 Btu/lb), have an LFL greater than 0.10 kg/m³, and have a maximum burning velocity of 10 cm/s or lower when tested in dry air at 73.4 °F (23.0 °C) and 14.7 psi (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 (8,169 Btu/lb) or greater or have an LFL of 0.10 kg/m³ or lower.

For flammability classifications, refrigerant blends are designated based on the worst case of formulation for flammability and the worst case of fractionation for flammability determined for the blend.

⁹ ASHRAE, 2022b. ANSI/ASHRAE Standard 34-2022: Designation and Safety Classification of Refrigerants.

⁷ www.epa.gov/greenchill/advanced-refrigeration.

⁸ Chillers used in supermarket systems are considered within the supermarket end-use under SNAP and the supermarket subsector under the Technology Transitions Program.

Figure 1. Refrigerant Safety Group Classification

| | | | |
|------------------------------|----------------------|--------------------------|-----|
| | Safety Group | | |
| ↑ Increasing Flammability | Higher Flammability | A3 | B3 |
| | Flammable | A2 | B2 |
| | Lower Flammability | A2L | B2L |
| | No Flame Propagation | A1 | B1 |
| | Lower Toxicity | Higher Toxicity | |
| | | → Increasing Toxicity | |

Using these safety group classifications, ASHRAE 34–2022 categorizes HFO–1234yf, HFO–1234ze(E), HFC–32 and the refrigerant blends R–454A, R–454C, R–455A, R–457A, and R–516A, which are discussed in this section of this rule, as being in the A2L Safety Group, while R–290 is in the A3 Safety Group.

3. What are HFO–1234yf, HFO–1234ze(E), R–454A, R–454C, R–455A, R–457A, and R–516A and how do they compare to other refrigerants in the same end-use?

HFO–1234yf and HFO–1234ze(E) are lower flammability single component refrigerants, and R–454A, R–454C, R–455A, R–457A, and R–516A are lower flammability refrigerant blends, all with an ASHRAE safety classification of A2L.¹⁰ The respective Chemical Abstracts Service Registry Identification Numbers (CAS Reg. Nos.) of HFO–1234yf, HFO–1234ze(E), and the components of the refrigerant blends are listed here.

HFO–1234yf, also known by the trade names “Solstice® yf” and “Opteon™ YF,” is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754–12–1). HFO–1234ze(E), also known by the trade names “Solstice® ze” and “Solstice® 1234ze,” is also known as *trans*-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118–24–9). R–516A, also

known by the trade name “Forane® 516A,” is a blend consisting of 77.5 percent HFO–1234yf, 14 percent HFC–152a, and 8.5 percent HFC–134a. R–457A, also known by the trade name “Forane® 457A,” is a blend consisting of 18 percent HFC–32, 12 percent HFC–152a, and 70 percent HFO–1234yf. R–455A, also known by the trade name “Solstice® L40X,” is a blend consisting of 21.5 percent HFC–32, 75.5 percent HFO–1234yf, and three percent R–744 (CO₂). R–454A, also known by the trade name “Opteon™ XL 40,” is a blend consisting of 35 percent HFC–32 and 65 percent HFO–1234yf. R–454C, also known by the trade name “Opteon™ XL 20,” is a blend consisting of 21.5 percent HFC–32 and 78.5 percent HFO–1234yf.

Redacted submissions and supporting documentation for HFO–1234yf, HFO–1234ze(E), R–454A, R–454C, R–455A, R–457A, and R–516A are provided in the docket for this rule (EPA–HQ–OAR–2023–0043) at <https://www.regulations.gov>. EPA performed a risk screening assessment to examine the health and environmental risks of each of these refrigerants. These risk screens are available in the docket for this rule.^{11 12 13 14 15 16 17}

¹¹ ICF, 2024a. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: HFO–1234yf.

¹² ICF, 2024b. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: HFO–1234ze(E) (Solstice® ze, Solstice® 1234ze)

¹³ ICF, 2024c. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: R–454A (Opteon® XL40).

¹⁴ ICF, 2024d. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: R–454C (Opteon™ XL20).

¹⁵ ICF, 2024e. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: R–455A (Solstice® L40X).

Environmental information: HFO–1234yf, HFO–1234ze(E) and R–454A, R–454C, R–455A, R–457A, and R–516A have ozone depletion potentials (ODPs) of zero.

HFO–1234yf and HFO–1234ze(E) both have a GWP of one.^{18 19} The refrigerant blends are made up of the components HFC–32, HFC–125, HFC–152a, CO₂, and HFO–1234yf, which have GWPs of 675, 3,500, 124, one, and one, respectively.²⁰ If these values are weighted by mass percentage, then R–454A, R–454C, R–455A, R–457A, and R–516A have GWPs of about 237, 146, 146, 137, and 140, respectively.

HFO–1234yf, HFO–1234ze(E), and the other components of the refrigerant blends, CO₂, HFC–32, HFC–125, and HFC–152a, are excluded from EPA’s regulatory definition of volatile organic

¹⁶ ICF, 2024f. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: R–457A (Forane® 457A).

¹⁷ ICF, 2024g. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: R–516A (Forane® 516A).

¹⁸ World Meteorological Organization (WMO) (2022). Burkholder *et al.* Appendix A, Table A–5 in *Scientific Assessment of Ozone Depletion: 2022*, GAW Report No. 278, 509 pp.; WMO, Geneva, Switzerland, <https://ozone.unep.org/science/assessment/sap>. (WMO, 2022).

¹⁹ Hodnebrog Ø. *et al.*, 2013. Hodnebrog Ø., Etmann, M., Fuglestvedt, J.S., Marston, G., Myhre, G., Nielsen, C.J., Shine, K.P., Wallington, T.J.: Global Warming Potentials and Radiative Efficiencies of Halocarbons and Related Compounds: A Comprehensive Review, *Reviews of Geophysics*, 51, 300–378, doi:10.1002/rog.20013, 2013.

²⁰ Unless otherwise specified, GWP values are 100-year values from Intergovernmental Panel on Climate Change (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*. S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.). Cambridge University Press. Cambridge, United Kingdom 996 pp.

¹⁰ EPA previously listed HFO–1234yf as acceptable, subject to use conditions, in motor vehicle AC in light-duty vehicles (74 FR 53445, October 19, 2009), in heavy-duty pickup trucks and complete heavy-duty vans (81 FR 86778, December 1, 2016) and in nonroad vehicles and service fittings for small refrigerant cans (87 FR 26276, May 4, 2022). EPA previously listed R–454A, R–454C, and R–457A as acceptable, subject to use conditions, as a substitute in residential and light commercial AC and heat pumps (86 FR 24444, May 6, 2021).

compounds (VOC) (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). That definition provides that “any compound of carbon” which “participates in atmospheric photochemical reactions” is considered a VOC unless expressly excluded in that provision based on a determination of “negligible photochemical reactivity.”²¹

None of the exemptions to the venting prohibition under CAA 608(c)(2) listed in 82.154(a)(1) apply to HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, or R-516A.

Flammability information: HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A have lower flammability, with an ASHRAE flammability classification of 2L. EPA evaluated flammability risk by evaluating reasonable worst-case and more typical, yet conservative, scenarios to model the effects of releases of these substitutes in the listed end-uses. These refrigerants are not expected to present a flammability concern provided the use conditions are followed. The use conditions provide additional safety measures and labeling requirements (e.g., visible warning statement and red coloring on the pipes, hoses, and devices which contain refrigerant) that make equipment owners, consumers, fire marshals, and emergency first responders aware of the presence of a flammability hazard.

Toxicity and exposure data: HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A have an ASHRAE toxicity classification of A (lower toxicity). Potential health effects of exposure to these refrigerants include drowsiness or dizziness. The refrigerants may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the refrigerants may cause irregular heartbeat. The refrigerants could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

OSHA has established a Permissible Exposure Limit (PEL) for CO₂ of 5,000 ppm as an 8-hr TWA. The American Industrial Hygiene Association (AIHA) has established Workplace Environmental Exposure Limits (WEELs) of 1,000 ppm as an 8-hr TWA for HFC-32, HFC-125, and HFC-152a and 500 ppm as an 8-hr TWA for HFO-1234yf. The manufacturer of HFO-

1234ze(E) recommends 800 ppm as an 8-hr TWA for that chemical, as does ASHRAE 34-2022. The manufacturers of R-454A, R-454C, R-455A, R-457A, and R-516A recommend acceptable exposure limits (AELs) for the workplace, respectively, of 690, 615, 650, 650, and 590 ppm on an 8-hr TWA for these blends.²² EPA anticipates that users will be able to meet the OSHA PEL, AIHA WEELs, and manufacturers' AELs and address potential health risks by following requirements and recommendations in the manufacturers' safety data sheets (SDSs), the final use conditions (including adherence to UL 60335-2-89 and ASHRAE 15-2022), and other safety precautions common to the refrigeration and AC industry.

Comparison to other substitutes in these end-uses: HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A all have an ODP of zero, comparable to or lower than some of the acceptable substitutes in these end-uses, such as CO₂, with an ODP of zero.

For new refrigerated food processing and dispensing equipment R-454C, R-455A, R-457A, and R-516A have GWPs ranging from 140 to 150, higher than that of CO₂, an acceptable substitute in this end-use category, with a GWP of one, while HFO-1234yf and HFO-1234ze(E) have comparable GWPs to CO₂ of one. The GWPs of HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A are lower than those of other acceptable HFC-134a, with GWPs of approximately 600, 630, and 1,430, respectively.

For new remote condensing units and supermarket systems, R-454A, R-454C, R-455A, R-457A, and R-516A have GWPs ranging from 140 to 237, higher than that of ammonia and CO₂, acceptable substitutes in these end-use categories, with GWPs of zero and one, respectively, while HFO-1234yf and HFO-1234ze(E) have comparable GWPs to CO₂ of one. The GWPs of HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A are lower than those of some of the acceptable substitutes for new remote condensing units and new supermarket systems, such as R-450A, R-513A, HFC-134a, R-407A, and R-404A, with GWPs of approximately 601, 630, 1,430, 2,110, and 3,922, respectively.

For new stand-alone units R-454C, R-455A, R-457A, and R-516A have GWPs ranging from 140 to 150, higher than some of the acceptable substitutes in

this end-use category such as CO₂, R-290, and R-441A with GWPs of one, three, and less than five, while HFO-1234yf and HFO-1234ze(E) have comparable GWPs to CO₂, R-290, and R-441A of one. The GWPs of HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A are lower than some of the acceptable substitutes for new stand-alone units, such as R-450A and R-513A, with GWPs of 601 and 630, respectively. As of January 1, 2025, certain HFCs and HFC blends will be subject to restrictions in new stand-alone units under the Technology Transitions Rule. In light of that upcoming restriction, EPA is listing HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A to provide additional lower-GWP refrigerants in this end-use. This upcoming restriction, and the corresponding value of providing additional lower-GWP refrigerants in this end-use, are additional considerations that informed EPA's decision on this listing.

Information regarding the toxicity of other available alternatives is provided in the listing decisions previously made (see <https://www.epa.gov/snap/retail-food-refrigeration>). Toxicity risks of use, determined by the likelihood of exceeding the exposure limit, of HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A in these end-uses are evaluated in the risk screens referenced previously. The toxicity risks of using HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A in retail food refrigeration equipment are comparable to or lower than toxicity risks of other available substitutes in the same end-uses. Toxicity risks of the refrigerants can be minimized by use consistent with UL 60335-2-89 and ASHRAE 15-2022—as required by the use conditions for these listings. EPA also anticipates that service technicians working with these systems will adhere to recommendations in the manufacturers' SDS for these refrigerants and other safety precautions common in the refrigeration and AC industry.

The flammability risks with HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A in these end-uses, determined by the likelihood of exceeding their respective LFLs, are evaluated in the risk screens referenced previously. Based on those risk screens, EPA's view is that while these refrigerants may pose greater flammability risk than other available substitutes in the same end-uses, this risk can be minimized by use consistent with UL 60335-2-89, ASHRAE 15-

²¹ Definitions under title 40 chapter I subchapter C part 51 subpart F CFR 51.100 can be found at <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-51/subpart-F/section-51.100>.

²² The 8-hr TWA AEL recommendations of these refrigerant blends are based upon a mass-weighting of the PEL and WEELs of their components. ASHRAE 34-2022 also recommends these occupational exposure limits.

2022, as well as recommendations in the manufacturers' SDS and other safety precautions common in the refrigeration and AC industry. EPA is finalizing use conditions to reduce the potential risk associated with the flammability of these alternatives so that they will not pose greater overall risk to human health and the environment than other acceptable substitutes in this end-use category.

In addition, the refrigerants listed through this action have lower GWPs than most other refrigerants currently in use today, though EPA notes that this is expected to shift in the future as entities begin complying with the restrictions under the 2023 Technology Transitions Rule for new equipment. These refrigerants provide additional lower-GWP options for situations where other refrigerants with lower GWPs may not be suitable. Given the wide range of applications for retail food refrigeration, not all refrigerants listed as acceptable under SNAP will be suitable for the range of equipment in the retail food refrigeration end-use or in the four end-use categories within retail food refrigeration. In this context, listing additional refrigerants as acceptable under SNAP provides additional options and increases the availability of substitutes for the full range of retail food refrigeration equipment with lower-GWP refrigerants, which is anticipated to lead to lower overall risk to human health and the environment. Accordingly, based on EPA's evaluation of the information discussed above and consideration of overall risk to human health and the environment, EPA is listing HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in all types of retail food refrigeration equipment. In addition, to account for the challenges for finding lower-GWP refrigerants with higher capacity for remote condensing units and supermarket systems with moderate charge sizes and for cascade systems, EPA is listing R-454A as acceptable, subject to use conditions, for use in remote condensing units and supermarket systems with a charge size capacity less than 200 pounds or for use in the high-temperature side of a cascade system.

4. Why is EPA finalizing these specific use conditions?

This final rule applies to end-uses covered by UL 60335-2-89. This standard applies to commercial and industrial refrigeration equipment, including the SNAP end-uses of retail food refrigeration, commercial ice machines, IPR, cold storage warehouses,

and ice skating rinks. ASHRAE 15-2022 also applies to these refrigeration systems.

UL 60335-2-89, as discussed in section II.H of this preamble, indicates that refrigerant charges greater than a specific amount (called "m₃" in the standard and based on the refrigerant's LFL) should be determined using national standards that apply, such as ASHRAE 15-2022. Hence, EPA is requiring adherence to both standards, when applicable, as use conditions for remote condensing units and supermarket systems.

EPA is incorporating by reference ASHRAE 15-2022 and UL 60335-2-89 in use conditions that apply to use of the A2L refrigerants listed through this action in new remote condensing units and supermarket systems. Where the requirements specified in this final rule and ASHRAE 15-2022 differ, the requirements of this final rule apply.

A partial summary of ASHRAE 15-2022 is provided here for information only. This is not meant to be a full explanation of the standard or how it is applied; for additional detail, please consult the standard. ASHRAE 15-2022 specifies requirements for refrigeration systems, based on the safety group classification of the refrigerant, the type of occupancy where the system is located, and whether refrigerant-containing parts of the system enter the space or ductwork such that leakage in the space is deemed "probable." "High-probability" installations are those such that leaks or failures will result in refrigerant entering occupied space. Occupancies are divided into six classifications: institutional, public assembly, residential, commercial, large mercantile, and industrial. Examples of these include jails, theaters, apartment buildings, office buildings, shopping malls, and chemical plants, respectively.

Sections 7.2 and 7.3 of ASHRAE 15-2022 determine the maximum amount of refrigerant allowed in the system, while section 7.4 provides an option to locate equipment outdoors or in a machinery room constructed and maintained under conditions specified in the standard. Section 7.7 of ASHRAE 15-2022 addresses the A2L refrigerants listed in this action when used in "high-probability" systems that are not for human comfort, including requirements for nameplates, labels, refrigerant detectors (under certain conditions), airflow initiation or other actions (if a rise in refrigerant concentration is detected), and other restrictions.

ASHRAE 15-2022 is undergoing continuous maintenance with publication of periodic addenda and is

typically updated and republished every three years. Although there were additional changes to ASHRAE 15-2022 between issuance of the proposed rule and now, EPA was not able to review and seek comment on use conditions based on those more recent changes after publication of the proposal. EPA is therefore not including addenda or other changes made to ASHRAE 15-2022 after the date of the proposed rule.

EPA is finalizing an additional use condition for R-454A in supermarkets and remote condensing units. This refrigerant may only be used either in equipment with a refrigerant charge capacity less than 200 pounds or in the high-temperature side of a cascade system. The Agency is finalizing this use condition to allow use of R-454A less broadly than for the other refrigerants being listed for use in remote condensing units and supermarket systems because its GWP is higher than those of the other listings for these end-use categories (about 237, compared to one to 150). EPA's understanding is that there are two particular situations where use of refrigerants is likely to be more constrained to minimize risks to human health and the environment, and thus, additional refrigerant options may be helpful.

The first of those situations is where ASHRAE 15-2022 identifies a refrigerating system as having a "high probability" that leaked refrigerant from a failed connection, seal, or component could enter an occupied area. ASHRAE 15-2022 and UL 60335-2-89 effectively set charge limits for A2L refrigerants to less than 260 times the LFL (approximately 200 pounds for A2L refrigerants and ranging from roughly 120 to 250 pounds for the particular refrigerants listed in this rule) for applications inside a supermarket or convenience store that are open to the general public. In contrast, larger charge sizes could be used in "low-probability" locations where the general public is unlikely to come in contact with the refrigerant, such as systems used in industrial occupancies, outdoors, or in a machinery room with access restricted to store employees. Where the general public is unlikely to come into contact with any leaked refrigerant, there would be fewer space constraints and greater flexibility in equipment design, so refrigeration system designers can accommodate a narrower set of refrigerants. Conversely, where the general public is more likely to come into contact with any leaked refrigerant in an interior space, which are not industrial occupancies, refrigerant charge capacities of a system would be

less than 200 pounds. In addition, in such public spaces there would be more space constraints, less flexibility in equipment design, and potentially stricter code requirements. EPA recognizes that these may be situations where R-454A can be used where those other refrigerants cannot, especially where space is constrained. Therefore, R-454A fills a gap in the stated end-uses where lower-GWP refrigerant alternatives posing less of a risk to human health and the environment are not as available, and R-454A's GWP of approximately 240 and similar toxicity and flammability profiles would pose lower overall risk to human health and the environment. Listing R-454A for supermarket systems and remote condensing units with smaller refrigerant charges provides an additional refrigerant to manage safety (in particular, flammability and toxicity) while achieving adequate performance where there may be more constraints. As some public commenters stated, R-454A has a higher volumetric capacity than the other A2L refrigerants with lower GWPs being listed in this rule, which means less refrigerant is needed and smaller refrigeration equipment can achieve the same cooling effect. Therefore, EPA is listing R-454A as acceptable, subject to use conditions, only for supermarket systems and remote condensing units with a use condition that refrigerant charge capacity shall be less than 200 pounds in order to mitigate risk to human health and the environment that could be associated with higher GWPs.

The second situation where use of refrigerants is likely to be more constrained is for use in the high-temperature side of cascade systems used for supermarket systems and remote condensing units. As discussed in section II.A.1 of this preamble, "Background on retail food refrigeration," each side²³ of a cascade system uses a different refrigerant that is most suitable for the given temperature range. High-temperature systems, or the "high-temperature side," have typically used HFCs as a refrigerant; however, it is technologically achievable and has become more common to use ammonia in the high-temperature side. For lower temperature systems, or the "low-temperature side" of the cascade system, refrigerants with low boiling points such as R-744 can be used. Considerations for the choice of refrigerants on either side of cascade systems are influenced by many factors

including, but not limited to, a refrigerant's toxicity and flammability, its temperature glide, and its suitability for lower temperature applications. Using flammable or toxic refrigerants, such as ammonia, on the high-temperature side of a cascade system may be limited in certain circumstances (e.g., based on building codes and/or industry safety standards). There are multiple substitutes available for the low-temperature side of a cascade system with GWPs lower than that of R-454A, but there are fewer options for the high-temperature side. Therefore, EPA is listing R-454A as acceptable, subject to use conditions, when it is used in the high-temperature side of cascade systems. This action expands the refrigerant options that can comply with local building codes and industry safety standards while meeting the more challenging application of the high-temperature side of a cascade system, and allowing for a refrigerant that would pose lower overall risks to human health and the environment than refrigerants that would otherwise be used.

5. What additional information is EPA including in these listings?

EPA is providing additional information related to these listings. Since this additional information is not part of the regulatory decision under SNAP, these statements are not binding for use of the refrigerant under the SNAP program. However, EPA encourages users of substitutes to apply all statements in the "Further Information" column in their use of these refrigerants. The additional information applies to multiple end-uses covered in this final rule. See section II.H.2 of this preamble for discussion on what additional information EPA is including in these listings.

6. How is EPA responding to comments on retail food refrigeration?

Comment: For the retail food refrigeration end-use, two commenters mentioned the proposed limitation on the use of R-454A and requested greater flexibility for that refrigerant and end-use. Both commenters indicated that R-454A is a higher capacity and more efficient refrigerant compared to alternatives with GWPs less than 150. The commenters stated that R-454A would provide greater flexibility to meet DOE efficiency requirements and claimed thermodynamic similarities to other refrigerants (R-404A, R-448A, and R-449A). One commenter requested that EPA not restrict R-454A in the high side of a cascade system and that R-454A be

approved for use in stand-alone units. Another commenter requested that EPA list R-454A as acceptable in all retail food refrigeration end-uses (stand-alone units, remote condensing units, supermarket systems, and refrigerated food processing and dispensing equipment). This commenter stated that EPA has sufficient information in the docket to allow EPA to add R-454A as acceptable in stand-alone units and refrigerated food processing and dispensing equipment, pointing to R-454A's zero ozone depletion potential and A2L classification.

Response: EPA acknowledges the commenters' request for greater flexibility to use R-454A. As discussed in section II.A.4 of this preamble, under the listings finalized in this rule, R-454A is acceptable, subject to use conditions, in the high side of a supermarket cascade system. Concerning the suggestion that R-454A would provide greater flexibility to meet DOE's energy conservation standards, EPA notes that EPA's SNAP program and DOE's program for energy conservation standards operate under separate authorities. If EPA had information showing that commercial refrigeration equipment manufactured using other refrigerants with lower GWPs were unable to be used in this application, EPA might consider broader use of R-454A in the future given there may not be other available or potentially available low-GWP substitutes for this application; however, absent such information, EPA is retaining the use conditions for R-454A in supermarket systems and remote condensing units in this final rule as proposed.

In response to comments supporting approval of R-454A in additional retail food end-use categories beyond supermarket systems and remote condensing units, such as stand-alone units and refrigerated food processing and dispensing equipment, EPA is not taking that action in this final rule because EPA did not propose to list R-454A and has not completed our consideration or analysis needed to reach a final decision whether to list this refrigerant in these other retail food end-uses. In response to the commenters' points about energy efficiency and capacity, these factors are not ones that are considered in 40 CFR 82.180(a)(7). Moreover, EPA notes that under the final Technology Transitions Rule (88 FR 73098; October 24, 2023), refrigerants containing HFCs used in retail food refrigeration—stand-alone units are limited to those with a GWP less than 150 beginning January 1, 2025; thus, even if EPA were to list R-454A

²³ Each side of the cascade system is a complete refrigeration system with a compressor, condenser, and evaporator.

as acceptable under the SNAP program, it still could not be used in stand-alone units after that date. EPA is finalizing the listings for R-454A as proposed, including listings for retail food refrigeration—supermarket systems and retail food refrigeration—remote condensing units, as acceptable, subject to use conditions.

Comment: Two commenters suggested that allowing R-454A would smooth the transition to low-GWP refrigerants in stand-alone units, enabling the industry to meet timing goals of the Technology Transitions Rule. A different commenter urged EPA to list R-454A for use in self-contained equipment. The third commenter stated that the quantity used in self-contained equipment is less than that used in remote equipment, thereby reducing the risk of any negative outcomes. This same commenter claimed that small companies do not have sufficient design resources to meet deadlines for both self-contained and remote equipment for different refrigerants. The commenter stated that allowing the use of R-454A in both self-contained and remote equipment would greatly reduce the time needed to transition to lower-GWP refrigerants.

Response: In response to the first two commenters' suggestion that listing R-454A as acceptable for stand-alone units would enable industry to meet the timing goals of the Technology Transitions Rule, we do not agree that R-454A is needed for timely compliance with that restriction. There are already substitutes that meet the 150 GWP limit available on the market for stand-alone retail food refrigeration. For example, R-290 has been listed as acceptable and has been used in stand-alone units for more than a decade. The Agency is aware of a number of substitutes, including R-290, which will be more broadly allowed, with larger charge sizes, through this rulemaking. Therefore, the Agency disagrees with the first two commenters that expanding the use of R-454A in this end-use is needed to meet requirements of the Technology Transitions Rule because there are already substitutes available in use for this purpose. EPA interprets the third commenter's request for use of R-454A in self-contained equipment to apply to retail food refrigeration (stand-alone units) and to retail food refrigeration (refrigerated food processing and dispensing equipment) that is self-contained, since EPA proposed that all commercial ice machines could use R-454A, and other types of appliances covered by this rule are not self-contained. EPA expects that such equipment in many cases could use other refrigerants with a GWP lower

than R-454A's GWP of 237, such as R-290, R-471A, R-454C, R-455A, or R-516A, with GWPs from three to less than 150. EPA also notes that under the final Technology Transitions Rule (88 FR 73098; October 24, 2023), refrigerants containing HFCs used in retail food refrigeration—stand-alone units are limited to those with a GWP less than 150 beginning January 1, 2025; thus, even if EPA were to list R-454A as acceptable for stand-alone units under the SNAP program, it still could not be used after that date. EPA also notes that for larger self-contained commercial ice machines with harvest capacities above certain levels, EPA is finalizing R-454A as acceptable, subject to use conditions (see section II.C.6 of this preamble).

Comment: One commenter recommended that EPA list HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A as acceptable for use in packaged systems in retail food refrigeration (e.g., walk-in coolers and freezers) as it was unclear if EPA intended the proposed listings to apply to packaged refrigeration systems. The commenter also asserted that the definitions for packaged refrigerating units in EPA's proposed Technology Transitions Rule and UL 60335-2-89 match and that the industry consensus standard that EPA proposed to incorporate by reference already includes such equipment within its scope.

Response: In response to this comment, EPA is clarifying that packaged refrigerating units fall within the same categories where the Agency is finalizing acceptable listings for those refrigerants. UL 60335-2-89 defines a packaged refrigerating unit as "a factory assembled unit for performing the complete refrigeration cycle (compressing gas, condensation or gas cooling, and evaporation) comprising power-driven refrigerant compressor(s) with motors, condensers or GAS COOLERS,²⁴ liquid receivers, interconnection pipe work, and ancillary equipment, all mounted on a common base." EPA classifies packaged refrigerating units for retail food refrigeration, such as walk-in coolers or freezers, as belonging either to the end-use category 'supermarket system' if the refrigerant is supplied on the same multi-compressor refrigerant circuit used to cool food elsewhere in the store or within the end-use category 'remote condensing unit' if only a one- or two-compressor system is used (generally dedicated to just the individual walk-in

cooler or freezer). (See also July 20, 2015; 80 FR 42901). If the packaged refrigerating unit is completely self-contained with no remote condenser, then it would belong to retail food refrigeration—stand-alone units. EPA proposed, and is finalizing, listings for HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, in retail food refrigeration—supermarket systems and retail food refrigeration—remote condensing units. In addition, EPA proposed, and is finalizing, listings for HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for retail food refrigeration—stand-alone units.

Comment: One commenter provided detailed comments on ice cream makers, requesting revisions to the proposal so they become an eligible end-use within the retail food refrigeration sector for the newly listed refrigerants in the final rule. The commenter noted that additional standards would need to be referenced in the final rule for ice cream makers to be included. Specifically, ice cream makers fall under UL 621 in North America and International Electrotechnical Commission (IEC) 60355-2-118 internationally; they are not in the scope of UL 60355-2-89. As such, the proposal would prevent ice cream equipment from using certain flammable low-GWP refrigerants, even when UL 621 and IEC 60335-2-118 have been updated to allow these substances. The commenter requested that EPA expand the use conditions for the food processing and dispensing equipment category to follow all relevant UL and IEC standards. The commenter added that the proposed listings for the sector would increase the cost of equipment due to the need to mitigate high-temperature discharges for refrigerants like R-454C and R-455A using special valves and compressors.

Response: EPA agrees with the commenter that equipment for ice cream makers is covered by UL 621 and not by UL 60335-2-89. EPA did not propose to require adherence to UL 621 as a use condition and notes that this standard is currently under development to address the safe use of flammable refrigerants. Therefore, the Agency is not adding requirements in the final rule specific to ice cream makers. EPA will continue to consider changes to relevant standards, and the Agency may consider whether any revisions to the SNAP regulations should be proposed at a future date. In this final rule, listings for refrigerated food processing and dispensing equipment do not apply to equipment that is manufactured according to UL

²⁴ This term is capitalized in the original text of UL's standard.

621, *i.e.*, commercial ice cream makers. In response to comments related to the cost of equipment for some of the listed refrigerants, EPA notes this rule does not require the use of any specific refrigerant; rather, this rule establishes requirements that allow for the safe use of the listed refrigerants, such that they do not pose overall greater risk to human health and the environment.

Comment: Two commenters claimed that the proposed rule's statement that the smallest types of retail food refrigeration utilize either brazed or welded refrigerant circuits was incorrect. The commenter stated that thread fittings are used in some cases and requested that this be accounted for in the final rule. Another commenter added that EPA had indicated that small units may be fully brazed and stated that some units may have components with screw fittings like cast iron compressors. They commented that regulations for A2L refrigerants should not require connections that are all brazed.

Response: EPA agrees with the comments regarding the incomplete and incorrect statement that the smallest types of retail food refrigeration utilize either brazen or welded refrigerant circuits. EPA did not intend the statement to imply that brazed connections would be required. In response to these comments, the description in section II.A.1 of this preamble also includes threaded fittings.

B. Retail Food Refrigeration—Listing R-290 as Acceptable, Subject to Use Conditions, for Use in New Refrigerated Food Processing and Dispensing Equipment and Revision of the Use Conditions Provided in the Previous Listings of R-290 as Acceptable, Subject to Use Conditions, for Use in New Stand-Alone Units

This final rule lists R-290 as acceptable, subject to use conditions, as a substitute for use in one additional end-use category under retail food refrigeration (*i.e.*, new refrigerated food processing and dispensing equipment). Further, EPA is also amending existing use conditions in the listing of R-290 as acceptable, subject to use conditions, for use in new stand-alone units. More specifically, EPA previously listed R-290 as acceptable, subject to use conditions, in new stand-alone units in SNAP Rule 17 (76 FR 78832, December 20, 2011). One of the use conditions established in that rule was adherence to an earlier standard, UL 471. In this final rule, we are revising those use conditions to be consistent with the most recent U.S. national standard for

retail food refrigeration equipment, UL 60335-2-89. Among other things, these revisions will allow safe use of larger charge sizes of R-290 than under UL 471, which will allow for broader use of R-290 as an alternative in these end-uses. Similar use conditions apply to other refrigerants with lower flammability in this SNAP action in section II.A of this preamble. The final use conditions are allowed for such equipment manufactured on or after the effective date of this final rule and do not apply to nor affect equipment manufactured before that effective date.

This revision to the use conditions incorporates by reference a newer industry standard, changing the reference from Supplement SB in the 10th edition of UL 471, "Commercial Refrigerators and Freezers," which was required in the earlier SNAP listing for R-290, to UL 60335-2-89. EPA is providing a transition period from the effective date of this final rule through September 29, 2024, during which stand-alone units manufactured with R-290 may follow either the earlier UL 471 standard or UL 60335-2-89. After the transition period ends, new stand-alone units manufactured with R-290 must follow UL 60335-2-89 for purposes of the SNAP program, unless the new stand-alone units remain essentially unchanged from an earlier model or design that was already UL-listed to the earlier UL 471 standard. Under EPA's understanding of these standards, if no design, manufacture, or other change is made to equipment that was certified to UL 471 before the sunset date, then the equipment may continue to be produced and used. To comply with the use condition, once a design change of any kind is made to equipment that has already been certified under UL 471, the equipment is required to be updated to UL 60335-2-89 requirements, including labeling.

Several use conditions finalized for these end-use categories are similar to those finalized for other end-uses. Because of this similarity, EPA discusses the use conditions that apply to all five end-uses in section II.H of this preamble. In summary, the common use conditions are: restricting the use of each refrigerant to new equipment that is specifically designed and clearly marked for that refrigerant; use consistent with ASHRAE 15-2022 and with UL 60335-2-89 (with certain exceptions), including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and requirements for warning labels and markings on equipment to inform consumers, technicians, and first

responders of potential flammability hazards.

In this final action, EPA is revising the existing listing for R-290 in new stand-alone units in appendix R to 40 CFR part 82, subpart G, and adding the new listing for R-290 in refrigerated food processing and dispensing units in appendix Y to 40 CFR part 82, subpart G. The regulatory text contains revised listing decisions for new stand-alone units in appendix R, as well as certain other previous listings that EPA is republishing for purposes of formatting for the **Federal Register**; EPA is not finalizing substantive changes to those earlier decisions (*e.g.*, listings for R-290, R-441A, and R-600a in household refrigerators and freezers and in vending machines).

1. Background on Retail Food Refrigeration

See section II.A.1 of this preamble for background on the retail food refrigeration end-use and particularly for the stand-alone units and refrigerated food processing and dispensing equipment end-use categories.

2. What are the ASHRAE classifications for refrigerant flammability?

ASHRAE 34-2022 categorizes R-290 as being in the A3 Safety Group. See section II.A.2 of this preamble for further discussion on ASHRAE classifications.

3. What is R-290 and how does it compare to other refrigerants in the refrigerated food processing and dispensing equipment end-use category?

R-290 is propane and has the formula C₃H₈ (CAS Reg. No. 74-98-6). Redacted submissions and supporting documentation for R-290 in retail food refrigeration are provided in the docket for this final rule (EPA-HQ-OAR-2023-0043) at <https://www.regulations.gov>. EPA performed a risk screening assessment to examine the health and environmental risks of this refrigerant. This risk screen is available in the docket for this final rule.²⁵

Environmental information: R-290 has an ODP of zero. R-290 has a GWP of three. R-290 is regulated as a VOC under CAA regulations (40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. EPA previously exempted R-290 in retail food refrigerators and freezers (stand-alone units only) from the venting prohibition under CAA

²⁵ ICF, 2023h. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: Propane (R-290).

section 608(c)(2), finding that such venting, release, or disposal does not pose a threat to the environment (79 FR 29682, May 23, 2014).

EPA evaluated potential impacts of R-290 and other HC refrigerants on local air quality. R-290 is considered a VOC and is not excluded from EPA's regulatory definition of VOC (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. As described later, EPA estimates that potential emissions of saturated HC refrigerants, such as R-290 and R-600a (isobutane), would not have a greater overall negative impact on local air quality than other acceptable substitutes in this end-use category.²⁶

EPA has conducted multiple analyses of various scenarios to consider the potential impacts on local air quality if HC refrigerants were used widely.²⁷ The analyses considered both worst-case and more realistic scenarios. In an analysis supporting the listings of R-290, R-600a, and the HC blend R-441A in multiple refrigeration and air conditioning end-uses in SNAP Rule 19 (80 FR 19454, April 10, 2015), the worst-case scenario assumed that the most reactive HC listed as acceptable as of the time of those listings (R-600a) was used in all refrigeration and AC uses and that all refrigerant used was emitted to the atmosphere rather than most being recovered. 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 parts per billion (ppb) in Los Angeles, which is the area with the highest level of ozone pollution in the United States. At the time of the analysis in 2014, 0.72 ppb was less than one percent of the NAAQS, and we stated at the time that the use of R-600a consistent with the use conditions required in EPA's regulations would not result in greater risk to the environment than other alternatives. Using the level of the current ozone NAAQS of 70 ppb, use of the most reactive saturated HC, R-600a, with a 100 percent market penetration would just exceed a level that might raise concerns for EPA. However, considering that R-290 is less reactive than R-600a²⁸ and that R-290 would

have a market penetration at least as high as that of R-600a,²⁹ we still consider use of saturated HC refrigerants not to result in greater overall risk to human health and the environment.

In a less conservative analysis of 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 acceptable under this final rule. For example, we assumed use of R-290 in refrigerated food processing and dispensing equipment³⁰ and in end-uses where it is already listed as acceptable, including retail food refrigeration—stand-alone units, vending machines, water coolers, self-contained commercial ice machines, room air conditioners, and household refrigerators and freezers. We also assumed the use of other HC refrigerants such as R-600a and R-441A in end-uses where they are listed as acceptable, such as in retail food refrigeration—stand-alone units, vending machines, and household refrigerators and freezers. For further information on the specific assumptions, see the docket for this rulemaking.³¹ Based on this still conservative but more probable assessment of refrigerant use, our assessment performed in 2014 found that even if all the refrigerant in appliances in end-uses addressed in this final rule and in appliances in end-uses for which other 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. This value is roughly 0.2 percent of the level of the current ozone NAAQS of 70 ppb on an 8-hour rolling average over a 6-month period between April and September of 2030. 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).³² 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.

EPA also has performed more recent air quality analyses, considering additional end-uses and HC refrigerants that have been listed acceptable more recently (e.g., R-1150 (ethylene) in very low temperature refrigeration) and using updated models.³³ EPA found that the revised air quality models showed slightly greater impacts compared to our 2014 analyses in all scenarios, but not enough to change our earlier conclusions in 2015 and 2016 that use of saturated HCs as refrigerants, including release of R-290, R-600a, and R-441A during repairing, maintaining, servicing, or disposing of appliances, would not result in a significant increase in ground-level ozone. Further, there would be no change in the prior conclusion that use of the saturated HCs R-290, R-600a, and R-441A, consistent with the SNAP listings, including their use conditions and the final use conditions in this rule, would not result in greater overall risk to people's health or the environment than other alternatives available under SNAP for the same end-use, refrigerated food processing and dispensing equipment.

Because of the relatively minimal air quality impacts of R-290 if it is released to the atmosphere from the end-uses where it is listed as acceptable subject to use conditions and from the refrigerated processing and dispensing equipment end-use category, even in a worst-case scenario, we conclude that R-290 does not have a greater overall impact on human health and the environment based on its effects on local air quality than other refrigerants listed as acceptable in the same end-uses.

Flammability information: R-290 is a higher flammability refrigerant, with an ASHRAE safety classification of A3. EPA evaluated flammability risk by evaluating reasonable worst-case and more typical, yet conservative, scenarios to model the effects of releases of R-290 in retail food refrigeration. This refrigerant is not expected to present a flammability concern provided the use conditions are followed. The use conditions provide additional safety measures and labeling requirements (e.g., visible warning statement and red coloring on the pipes, hoses, and devices which contain refrigerant) that make equipment owners, consumers, fire marshals, and emergency first

²⁶ ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

²⁷ *Ibid.*

²⁸ R-600a has a MIR of 1.34 g O₃/g R-600a, while R-290 has a MIR of 0.56 g O₃/g R-290. ICF, 2023h, Op. cit.; Carter, 2010. "Development of the SAPRC-07 Chemical Mechanism and Updated Ozone Reactivity Scales," Report to the California Air Resources Board by William P. L. Carter. Revised January 27, 2010.

²⁹ *Ibid.*

³⁰ In the analysis, refrigerated food processing and dispensing equipment was evaluated under the category of "small retail food" refrigeration equipment, along with stand-alone units, vending machines, and water coolers.

³¹ ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February 2014.

³² *Ibid.*

³³ ICF, 2022. Additional Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. May 2020. Updated models included VM IO file_v5.1_10.01.19 and CMAQ 5.2.1 with carbon bond 06 (CB06) mechanism, as cited in ICF, 2022.

responders aware of the presence of a flammability hazard.

Toxicity and exposure data: R-290 has an ASHRAE toxicity classification of A (lower toxicity). Potential health effects of exposure to this refrigerant include drowsiness or dizziness. The refrigerant may also irritate the skin or eyes or cause frostbite. This refrigerant could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

OSHA has established a PEL of 1,000 ppm as an 8-hr TWA for R-290. EPA anticipates that users will be able to meet OSHA's PEL and address potential health risks by following requirements and recommendations in the manufacturers' SDSs, the final use conditions (including compliance with UL 60335-2-89), adherence to ASHRAE 15-2022, and other safety precautions common to the refrigeration and AC industry.

Comparison to other substitutes in the refrigerated food processing and dispensing end-use category: R-290 has an ODP of zero, comparable to or lower than some of the acceptable substitutes in new refrigerated food processing and dispensing equipment, such as CO₂, R-450A, and R-513A, with ODPs of zero.

R-290's GWP of three is comparable to that of other acceptable substitutes for new refrigerated food processing and dispensing equipment, including CO₂, with a GWP of one. The GWP of R-290 is lower than some of the acceptable substitutes for new refrigerated food processing and dispensing equipment, such as R-450A, R-513A, R-134a, and R-407H, with GWPs of approximately 600, 630, 1,430, and 1,500, respectively.

EPA's risk screen for R-290 in retail food refrigeration,³⁴ including refrigerated food processing and dispensing equipment, found that R-290 can be used without exceeding its PEL of 1,000 ppm (8-hr TWA); thus, the toxicity risks of R-290 are comparable to those of other acceptable substitutes in the refrigerated food processing and dispensing equipment end-use category, which also are used without exceeding their workplace exposure limits.

Although the flammability of R-290 may be greater than that of other available refrigerants with an ASHRAE 1, 2, or 2L flammability classification in the same end-use, we found its flammability risk to be comparable to those of other acceptable substitutes, even under worst-case assumptions in this end-use category when following the final use conditions.³⁵ We note that

flammability risk can be minimized by use consistent with industry standards such as UL 60335-2-89—which applies under the use conditions—and ASHRAE 15-2022—which also applies under the use conditions—as well as recommendations in the manufacturers' SDS and other safety precautions common in the refrigeration and air conditioning industry. EPA is finalizing use conditions that reduce the flammability risk associated with this alternative so that it will not pose greater overall risk to human health and the environment than other acceptable substitutes in this end-use category.

Based on the results of these analyses, EPA is listing R-290 as acceptable, subject to use conditions, in refrigerated food processing and dispensing equipment. R-290 has a GWP of three, lower than that of most other available alternatives for the same end-use category with similarly low toxicity. R-290 provides an additional lower-GWP option for situations where other refrigerants with lower GWPs are not viable, such as where equipment using CO₂ may not be able to meet DOE's energy conservation standards. To provide an additional, lower-GWP option with lower overall risk to human health and the environment, EPA is listing R-290 as acceptable, subject to use conditions, for use in refrigerated food processing and dispensing equipment.

4. Why is EPA finalizing these specific use conditions for refrigerated food processing and dispensing equipment?

For refrigerated food processing and dispensing equipment, EPA is requiring adherence to UL 60335-2-89 for equipment falling under the scope of that standard. Several of the use conditions for refrigerated food processing and dispensing equipment are common to those finalized for R-290 in the commercial ice machine end-use as discussed in section II.D of this preamble. Other use conditions are common to all refrigerants and all five end-uses in this final rule. Because of this similarity, EPA discusses the use conditions that apply to all five end-uses in section II.H of this preamble. In summary, the common use conditions for all five end-uses are: restricting the use of each refrigerant to new equipment that is specifically designed and clearly marked for that refrigerant; use consistent with ASHRAE 15-2022 and with UL 60335-2-89 (with certain exceptions), including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and requirements for warning labels and

markings on equipment to inform consumers, technicians, and first responders of potential flammability hazards.

5. How does the listing for R-290 in refrigerated food processing and dispensing equipment relate to regulations implementing the venting prohibition under CAA section 608?

In section II.I of this preamble EPA is finalizing an exemption for R-290 used as a refrigerant in refrigerated food processing and dispensing equipment from the prohibition under CAA section 608(c)(2) on knowingly venting or otherwise knowingly releasing or disposing of any substitute refrigerant in the course of maintaining, servicing, repairing, or disposing of an appliance or IPR.

6. What existing use conditions apply to this refrigerant in the stand-alone units end-use category?

EPA previously listed R-290 acceptable, subject to use conditions, in new stand-alone units in SNAP Rule 17 (76 FR 78832, December 20, 2011). Those requirements are codified in appendix R to 40 CFR part 82, subpart G. EPA provided information on the potential environmental and health risks of R-290 and the various refrigerants available at that time for use in this end-use category. EPA's previous risk screen for this refrigerant in this end-use category, based on the use conditions in that rule, is available in the docket for that previous rulemaking (EPA-HQ-OAR-2009-0286).

R-290 has an ASHRAE classification of A3, indicating that it has low toxicity and higher flammability. In the presence of an ignition source (e.g., static electricity, a spark resulting from a closing door, or a cigarette), an explosion or a fire could occur if the concentration of R-290 were to exceed the LFL of 21,000 ppm (2.1 percent) by volume.

The use conditions established in the SNAP Rule 17 for R-290 in new stand-alone units addressed safe use of this flammable refrigerant based on information available at that time and included the following: incorporation by reference of Supplement SB to the 10th edition (November 24, 2010) of UL 471 "Commercial Refrigerators and Freezers;" refrigerant charge size limits based on cooling capacity and type of equipment; and requirements for markings and warning labels on equipment using the refrigerant to inform consumers, technicians, and first responders of potential flammability hazards. EPA explained in that rulemaking that without appropriate use

³⁴ ICF, 2023h. Op. cit.

³⁵ ICF, 2023h. Op. cit.

conditions, the flammability risk posed by this refrigerant could be higher than non-flammable refrigerants because individuals may not be aware that their actions could potentially cause a fire, and because the refrigerant could be used in existing equipment that has not been designed specifically to minimize flammability risks. Our assessment and listing decisions in SNAP Rule 17 (76 FR 78832, December 20, 2011) found that with the use conditions, the overall risk of R-290, including the risk due to flammability, was not greater in the stand-alone units end-use than other substitutes that are currently or potentially available for that same end-use.

7. What updates to existing use conditions for stand-alone units is EPA finalizing?

EPA is finalizing the proposed use conditions that apply to R-290 in new stand-alone units manufactured on or after the effective date of this final rule. The updated use conditions finalized for use of R-290 in stand-alone units are common to those finalized for the commercial ice machine end-use in section II.D of this preamble, and others are common to all five end-uses in this final rule. Because of this similarity, EPA discusses the use conditions that apply to all five end-uses in section II.H of this preamble. For R-290 in stand-alone units, these use conditions in sections II.D and II.H of this preamble are the only revised use conditions EPA is finalizing—*i.e.*, there are no use conditions pertaining to refrigerant charge capacity or specific applications within stand-alone units. In summary, with the updates finalized for the use conditions for stand-alone units, the common use conditions are: restricting the use of each refrigerant to new equipment that is specifically designed and clearly marked for that refrigerant; use consistent with ASHRAE 15-2022 and with UL 60335-2-89 (with certain exceptions), including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and requirements for warning labels and markings on equipment to inform consumers, technicians, and first responders of potential flammability hazards.

EPA is finalizing the use conditions in this action, which apply to new stand-alone units on or after the effective date of this final rule. This final rule does not apply to nor affect equipment manufactured before the effective date of this action. The final regulatory text presents these different requirements as numbered listings in separate table

rows, where the end-use and the effective time period during which the equipment is manufactured are in the left-most column, with the heading “End-use”; the specific requirements are listed as use conditions in the fourth column, with the heading “Use Conditions.” Under SNAP, EPA views equipment to be manufactured at the date upon which the appliance’s refrigerant circuit is complete, the appliance can function, the appliance holds a full refrigerant charge, and the appliance is ready for use for its intended purposes. For stand-alone units (and most refrigerated food processing and dispensing equipment), this occurs at the factory. New stand-alone units manufactured between February 21, 2012, and the effective date of the final rule that use R-290 are required to meet the use conditions in SNAP Rule 17 (which took effect February 21, 2012) and as listed in appendix R to 40 CFR part 82, subpart G (in listing 2), including the use condition incorporating by reference Supplement SB to the 10th edition of UL 471. Such products are permitted to be warehoused and sold through normal channels, even if they are sold after the effective date of this final rule. Stand-alone units using R-290 manufactured on or after the effective date of this final rule are required to meet the use conditions finalized and listed in the revisions to appendix R. Those use conditions allow manufacturers of new stand-alone units using R-290 to follow either UL 471 or UL 60335-2-89 from the effective date of this final rule and through September 29, 2024, which is the date when UL is sunsetting UL 471. On and after September 30, 2024, new stand-alone units using R-290 for any new equipment designs or models must meet UL 60335-2-89; for an unchanged model or design that was already listed by UL—that is, certified to meet the requirements of UL 471—the equipment can continue to be manufactured according to that standard’s requirements.

EPA is finalizing use conditions allowing all new stand-alone units using R-290 to be manufactured consistent with Supplement SB of UL 471, up to and including September 29, 2024. Therefore, during the time between the effective date of this final rule and September 29, 2024, manufacturers may follow either UL 471, 10th edition or UL 60335-2-89, 2nd edition, depending on which standard the equipment was designed to. This transition date was in this rule’s proposal in order to align with the industry standard sunsetting date for UL 471. It is EPA’s

understanding that since proposal, UL has discussed updating its effective date when UL 60335-2-89 replaces UL 471 to reflect a later continuing certification date. EPA is allowing manufacturers to adhere to either standard for this limited time because the Agency recognizes that manufacturers may need time to make necessary changes including to their product labels. The period during which manufacturers may follow either standard should provide sufficient time for manufacturers to transition from UL 471 to UL 60335-2-89 while designing and testing new models and designs. Beginning September 30, 2024, for the purposes of the SNAP program, newly manufactured stand-alone units of new models and designs using R-290 must meet the requirements of UL 60335-2-89. Newly manufactured stand-alone units of existing models and designs that are certified (*e.g.*, UL-listed) using R-290 that remain unchanged other than cosmetic changes (*e.g.*, color changes) and that meet Supplement SB of UL 471 prior to September 30, 2024, may continue to meet those requirements after that date. In addition, we are requiring manufacturers to follow the set of use conditions that correspond with a specific UL standard (*e.g.*, we are including text in the revisions to appendix R stating that when an entity is using UL 471, it is to follow all use conditions in listing 2 and when using UL 60335-2-89, it is to follow all use conditions in listing 4 in the final revisions to appendix R). See section II.H.1 of this preamble for further discussion on the requirements of UL 60335-2-89, 2nd edition, which EPA is incorporating by reference.

EPA also notes that we are continuing to apply without revision two existing use conditions, nor did we take comment on those two existing use conditions. The use conditions finalized in this rule that restrict the use of R-290 to new equipment specifically designed for this refrigerant, and that require red-colored markings on service ports, pipes, hoses, and other devices through which the refrigerant is serviced, repeat the existing use conditions for R-290 in new stand-alone units.

8. How do the new use conditions for R-290 in stand-alone units differ from the existing ones and why is EPA changing the use conditions?

The revised use conditions EPA is finalizing for R-290 in stand-alone units are the same as or similar to the ones that exist today in appendix R to 40 CFR part 82, subpart G, for R-290 in this end-use category. The final requirements that R-290 must be used in new equipment only, and that new

stand-alone units must include red markings at service ports, pipes, hoses, and other devices through which the refrigerant is serviced, are repeated in this final listing. The revised use conditions concern incorporating by reference the most recent U.S. national industry safety standard and updated labeling requirements consistent with that new standard. Stand-alone units using R-290 manufactured before the effective date of this final rule are not affected by the revised use conditions.

Warning labels are required under EPA's use restrictions for R-290 in stand-alone units, and EPA is continuing to require them, although with some specific language changes. The finalized warning labels are similar to those already established as use conditions for the use of R-290 in stand-alone units. Using a common set of labels, similar to those from UL 60335-2-89, will aid in compliance and reduce burden for the industry, especially for a manufacturer that uses more than one refrigerant. EPA is finalizing that the labels must be provided in letters no less than 6.4 millimeter (¼ inch) high and must be permanent, which is identical to the existing requirement for R-290 in stand-alone units.

EPA is incorporating by reference a newer industry standard in the use conditions, including use of UL 60335-2-89, 2nd edition for equipment newly designed and manufactured on or after the effective date of this final rule instead of continuing to require Supplement SB of the 10th edition of UL 471. UL 60335-2-89 was developed in an open and consensus-based approach, with the assistance of experts in the refrigeration and AC industry as well as experts involved in assessing the safety of products. The revision cycle for the 2nd edition, including final recirculation, concluded with its publication on October 27, 2021. UL 60335-2-89 replaces the previously published version of several standards, including UL 471, which had already been published as a 10th edition by that time. EPA was aware of the continuing progress of UL standards to address flammable refrigerants. In SNAP Rule 23 (86 FR 24444, May 6, 2021), which listed a number of A2L refrigerants for use in the residential and light commercial AC and heat pumps end-use, we stated, "EPA understands that the standard we relied on in [SNAP] Rule 19 might 'sunset' in the future. Therefore, we will continue to evaluate the market for the equipment addressed in that rule, including R-290 in stand-alone units, and whether to establish new or revised use conditions that reference UL 60335-2-89." Today, we

are finalizing such a change knowing that the standard to which such equipment is UL-listed will transition from UL 471 to the most recent standard, UL 60335-2-89, for newly designed and manufactured equipment as of September 30, 2024.

To allow time for manufacturers of stand-alone units to transition between the existing use condition using the 10th edition of UL 471 and the new use condition using UL 60335-2-89, EPA is allowing R-290 to be used in stand-alone units manufactured either following UL 471 or UL 60335-2-89 during a transition period. That transition period begins on the effective date of this final rule, July 15, 2024, and lasts through September 29, 2024. It is EPA's understanding that UL intends to sunset UL 471 on September 29, 2024, and EPA is coordinating with that sunset date. Further, based on public comments, EPA understands that UL allows newly manufactured equipment that remains unchanged from its previous UL-listed (certified) design or model to continue to follow an earlier standard such as UL 471 because the manufacturer has made no changes. EPA intends to follow this practice, as well, in this final rule. Beginning September 30, 2024, the use condition allows R-290 to be used in new stand-alone units that follow UL 60335-2-89, or for newly manufactured stand-alone units that are unchanged from the model or design previously UL-listed as meeting UL 471 10th edition. In addition, manufacturers must follow the set of use conditions that correspond with a specific UL standard (*i.e.*, when using UL 471, follow all use conditions in listing 4 and when using UL 60335-2-89, follow all use conditions in listing 6 in the final revisions to appendix R).

Another revision to the use conditions is the limit on charge sizes. The existing use conditions from SNAP Rule 17 require the charge sizes to be calculated consistent with UL 471, with a maximum charge of 150 g allowed. The final revised use conditions for equipment newly designed and manufactured on or after the effective date of this final rule allow charge sizes calculated based on UL 60335-2-89, which allows charges of up to roughly 500 g of R-290 for open stand-alone units, or roughly 300 g for those with doors and drawers. These changes allow the use of R-290 in larger equipment than previously and provide more options for industry, while mitigating flammability or exposure risk and maintaining safety within a comparative risk framework.

Because of the differences between UL 471 and UL 60335-2-89, EPA

performed a new risk screen for R-290 as a refrigerant in retail food refrigeration equipment, including stand-alone units.³⁶ In this risk screen, EPA adjusted charge sizes to be consistent with the larger charge sizes of roughly 300 g and 500 g allowed for R-290 under UL 60335-2-89. The risk screen also considered the impact of mitigation methods such as valves that would restrict the amount of refrigerant that could be released, with a limit on "releasable charge." The updated risk screen found that concentrations of R-290 still would not exceed the LFL when used according to the new use condition with releasable charge and larger charge sizes and consistent with UL 60335-2-89, and thus the new use conditions also address potential flammability risks of using R-290.³⁷ In addition, the risk screen modeled the reasonable worst-case scenario of short-term exposure (15-minute TWA) due to a catastrophic release of the charge. Under this highly conservative scenario, the worst-case exposure of 5,770 ppm was still significantly lower than the Acute Toxicity Exposure Limit (ATEL) of 50,000 ppm.³⁸ According to ASHRAE 34, R-290 is listed under safety group A3 with an ATEL of 50,000 ppm. ASHRAE 34 ATELS are intended to reduce the risks of acute toxicity, asphyxiation, and flammability hazards in normally occupied, enclosed spaces during refrigerant use and protect end-users from the potential dangers of a catastrophic leak from a refrigeration unit. For further information, see the risk screen³⁹ for R-290 in the docket for this rulemaking.

9. What additional information is EPA including in these listings?

EPA is providing additional information related to this final listing for R-290 in new refrigerated food processing and dispensing equipment and the final listing for R-290 in new stand-alone units. Since this additional information is not part of the regulatory decision under SNAP, these statements are not binding for use of the refrigerant under the SNAP program. See section II.H.2 of this preamble for further discussion on what additional information EPA is including in these listings. This additional information is similar to, but not identical with, the additional information in the listing for R-290 in stand-alone units in SNAP Rule 17, which included additional

³⁶ ICF, 2023h. *Op. cit.*

³⁷ *Ibid.*

³⁸ The source of the ATEL is ASHRAE 34-2022, as cited in ICF, 2023h. *Op. cit.*

³⁹ ICF, 2023h. *Op. cit.*

information such as applicable OSHA requirements, need for proper ventilation, use of personal protective equipment, fire extinguishers to keep nearby, use of spark-proof tools and recovery equipment designed for flammable refrigerants, and suggestions for technician training. EPA is finalizing additional information consistent with that included in the final listings for other refrigerants in stand-alone units in this rule and consistent with that included in the listings for R-290 as acceptable, subject to use conditions, in stand-alone units in Rule 17, with additional information such as recommendations for actions to take in case of an accidental release, additional recommended practices for technicians, DOT requirements for transport of flammable gases, and statement that disposed flammable refrigerant is likely to be hazardous waste under RCRA. 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 refrigerants.

10. How is EPA responding to comments on listing R-290 in refrigerated food processing and dispensing equipment and updating the use conditions for R-290 in stand-alone units?

Several commenters provided input on listing R-290 as a substitute.

Comment: Two commenters referenced charge size considerations for R-290 and asked that EPA align the final rule with industry standards to reduce confusion. One commenter asked EPA to conform its description of R-290 charge sizes to those allowed under UL 60335-2-89 and ASHRAE 15: 13 times the LFL for open appliances (494 g), eight times the LFL for closed appliances with doors and drawers (304 g), and 3 times the LFL in public corridors and lobbies (114 g). To avoid confusion, they cautioned EPA to avoid noting that a charge limit of 500 g of R-290 is permitted. The same commenter noted that larger charge sizes of R-290 are only permitted for products listed to UL 60335-2-89, and not UL 471. A different commenter added that the UL 60335-2-89 standard for stand-alone retail food refrigeration equipment with R-290 is thorough and sufficient. They mentioned that conversion of self-contained refrigeration equipment using R-290 is currently constrained by the use restrictions for stand-alone retail food refrigeration (150 grams or less in UL 471). They added that work remains to properly and safely convert products that require larger charges of R-290 to

supply the cooling capacity needed. Another commenter requested that EPA allow larger charges of R-290 in the high side of cascade systems or secondary systems in all applications. They stated that R-290 can be paired with carbon dioxide to make an energy efficient system in warmer climates. They added that the International Institute of Ammonia Refrigeration (IAR) is developing a standard specifically for the use of R-290.

Response: EPA agrees with the commenters concerning the description of charge sizes for R-290 and the related requirements of UL 60335-2-89 and ASHRAE 15. Specifically, UL 60335-2-89 limits charge sizes for R-290 to 13 times the LFL for open appliances (494 g), eight times the LFL for closed appliances with doors and drawers (304 g), and ASHRAE 15-2022 limits charges to 3 times the LFL in public corridors and lobbies (114 g). As noted by the commenters, the charge size limit for R-290 is 150 g for equipment following UL 471. EPA did not propose to list R-290 as acceptable, subject to use conditions, for the high side of cascade systems or secondary loop systems in all applications and did not receive information in a submission for such uses of R-290; thus, EPA has not performed necessary analysis to make a listing decision nor provided an opportunity for comment on that analysis. EPA also notes that the current edition (2nd edition) of UL 60335-2-89 only allows use of A3 (higher flammability) refrigerants in self-contained equipment, which applies to stand-alone units and to some refrigerated food processing and dispensing equipment, not to supermarket systems or remote condensing units. In response to the comments regarding IAR standard development, EPA would first need to review a final standard and propose it as a use condition before requiring it in a final listing; thus, this comment is beyond the scope of this rulemaking. EPA will continue to monitor development of and changes to relevant standards, and the Agency may consider whether any additions to or revisions to the SNAP program regulations should be proposed at a future date.

Comment: One commenter stated that expanding the use of R-290, with a low GWP, will help minimize harmful climate impacts of refrigerant emissions while maintaining safe systems.

Response: EPA agrees in general that allowing greater use of R-290 would allow for lower climate impacts, and so long as R-290 is used according to the use conditions in this final rule, we

expect it will be used as safely as other available substitutes for the same uses.

C. Commercial Ice Machines—Listing of HFC-32, HFO-1234yf, R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A as Acceptable, Subject to Use Conditions, for Use in New Commercial Ice Machines

This final rule lists HFC-32, HFO-1234yf, and the refrigerant blends R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new commercial ice machines. The listings for refrigerants HFC-32, R-454A, and R-454B are being finalized in this rule only for larger equipment—specifically, remote commercial ice machines, self-contained batch-type commercial ice machines with a harvest rate greater than 1,000 lb ice per 24 hours, and self-contained continuous-type commercial ice machines with a harvest rate above 1,200 lb ice per 24 hours; EPA is not finalizing listings for those three refrigerants for smaller commercial ice machines at this time.

Several use conditions finalized for commercial ice machines are common to those finalized for other end-uses. Because of this similarity, EPA discusses the use conditions that apply to all five end-uses in section II.H of this preamble. For commercial ice machines, those are the only use conditions EPA is finalizing. In summary, the common use conditions are: restricting the use of each refrigerant to new equipment that is specifically designed and clearly marked for that refrigerant; use consistent with ASHRAE 15-2022 and with UL 60335-2-89 (with certain exceptions), including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and requirements for warning labels and markings on equipment to inform consumers, technicians, and first responders of potential flammability hazards.

In this final action, EPA is revising the existing listing for R-290 in new self-contained commercial ice machines in appendix V to 40 CFR part 82, subpart G. The regulatory text contains listing decisions for the commercial ice machines end-use, as well as certain other previous listings that EPA is republishing for purposes of formatting for the **Federal Register**; EPA is not finalizing substantive changes to those earlier decisions, e.g., listings for R-290 in new water coolers and in new very low temperature refrigeration equipment.

1. Background on Commercial Ice Machines

Commercial ice machines are used in commercial establishments (e.g., hotels, restaurants, convenience stores) to produce ice for consumer use. Commercial ice machines⁴⁰ are another subset of commercial refrigeration and are considered a separate end-use within the SNAP program from retail food refrigeration due to differences in where such equipment is placed and the additional mechanical and electronic components required to make and dispense ice. Ice machines produce ice in various sizes and shapes, and with different retrieval mechanisms (e.g., dispensers or self-retrieval from bins). 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 refrigerated lines running between the two (also known as remote condensing equipment). The listings described in section II.C.4 of this preamble apply both to larger self-contained commercial ice machines and to remote condensing commercial ice machines. Commercial ice machines fall under the scope of UL 60335-2-89, “Household and Similar Electrical Appliances—Safety—Part 2-89: Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor.”

Commercial ice machines can also be divided between batch-type machines (e.g., providing cubed ice) and continuous-type machines (e.g., providing flaked ice). Batch-type (also called cube type) ice machines harvest ice with alternating freezing and harvesting periods. Batch-type commercial ice machines can be used in a variety of applications but are generally used to generate ice for use in beverages. Batch-type commercial ice machines are often employed in hotels, hospitals, and restaurants where beverages are served. Continuous-type ice makers produce ice through a continuous freeze and harvest process and include flake and nugget ice machines. Flake ice is used primarily in food displays, such as seafood grocery store displays or salad bars, whereas nugget ice (also known as chewable ice) is primarily used in beverage applications such as smoothies and blended cocktails. DOE sets energy conservation standards for commercial ice machines and distinguishes these

⁴⁰ Industry standards for this type of equipment, e.g., UL 563 and UL 60335-2-89, use the terms “ice maker” or “ice-maker” rather than commercial ice machines. The terms may be used interchangeably and refer to the same equipment.

based in part on their harvest rate,⁴¹ defined as “as the amount of ice (at 32 degrees F) in pounds produced per 24 hours.” 10 CFR 431.132.

R-404A has commonly been used in remote condensing commercial ice machines, while both R-404A and R-410A have been commonly used in self-contained commercial ice machines. Recently, there has been the introduction of smaller self-contained commercial ice machines that use R-290.

2. What are the ASHRAE classifications for refrigerant flammability?

ASHRAE 34-2022 categorizes the refrigerants for commercial ice machines in this section as being in the A2L Safety Group. See section II.A.2 of this preamble for further discussion on ASHRAE classifications of these refrigerants.

3. What are HFC-32, HFO-1234yf, R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A and how do they compare to other refrigerants in the same end-use?

See section II.A.3 of this preamble for further discussion on the identity, environmental, flammability, toxicity, and exposure information for HFO-1234yf, R-454A, R-454C, R-455A, R-457A, and R-516A.⁴²

HFC-32 is also known as R-32 or difluoromethane (CAS Reg. No. 75-10-5). R-454B, also known by the trade names “Opteon™ XL 41” and “Puron Advance™,” is a blend consisting of 68.9 percent HFC-32 and 31.1 percent HFO-1234yf. Redacted submissions and supporting documentation for HFC-32, HFO-1234yf, and the refrigerant blends are provided in the docket for this rule (EPA-HQ-OAR-2023-0043) at <https://www.regulations.gov>. EPA performed a risk screening assessment to examine the health and environmental risks of each of these refrigerants. These risk

⁴¹ For purposes of this rule, the harvest rate shall be determined in accordance with 10 CFR 431.134.

⁴² EPA previously listed HFO-1234yf as acceptable, subject to use conditions, in motor vehicle AC in light-duty vehicles (74 FR 53445, October 19, 2009), in heavy-duty pickup trucks and complete heavy-duty vans (81 FR 86778, December 1, 2016) and in nonroad vehicles and service fittings for small refrigerant cans (87 FR 26276, May 4, 2022). EPA previously listed R-454A, R-454B, R-454C, and R-457A as acceptable, subject to use conditions, as substitutes in residential and light commercial AC and heat pumps (86 FR 24444, May 6, 2021). EPA previously listed HFC-32 as acceptable, subject to use conditions, in self-contained room air conditioners (80 FR 19453, April 10, 2015) and listed HFC-32 as acceptable, subject to use conditions, in the remaining types of residential and light commercial air conditioning and heat pumps.

screens are available in the docket for this rule.^{43 44 45 46 47 48 49 50}

Environmental information: HFC-32 and R-454B, as well as the other refrigerants being listed in this end-use, have ODPs of zero.

HFC-32 has a GWP of 675. If the GWPs for the components of R-454B, HFC-32 and HFO-1234yf (GWP of one), are weighted by mass percentage, then the blend R-454B has a GWP of about 465.

Both of the components of R-454B, HFC-32 and HFO-1234yf, are excluded from EPA’s regulatory definition of VOC (see 40 CFR 51.100(s)) for the purpose of addressing the development of SIPs to attain and maintain the NAAQS.

Under section 608(c)(2) of the CAA and EPA’s regulations at 40 CFR 82.154(a)(1), 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 substitute substance for a class I or class II substance used as a refrigerant in such appliance (or IPR) in a manner which permits such substance to enter the environment. EPA has established certain limited exemptions to this venting prohibition, as listed in 40 CFR 82.154(a)(1), but none of those exemptions apply to HFC-32 or R-454B.

Flammability information: HFC-32 and R-454B are both classified as 2L refrigerants under ASHRAE Standards reflecting that these compounds are flammable but have lower burning velocity than compounds listed as 2 or 3 under the ASHRAE standard. EPA evaluated flammability risk by evaluating reasonable worst-case and more typical, yet conservative, scenarios to model the effects of releases of HFC-32 and R-454B, respectively, in the listed end-uses. These refrigerants are

⁴³ ICF, 2024i. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: HFC-32.

⁴⁴ ICF, 2024j. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: HFO-1234yf.

⁴⁵ ICF, 2024k. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-454A (Opteon® XL40).

⁴⁶ ICF, 2024l. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-454B.

⁴⁷ ICF, 2024m. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-454C (Opteon™ XL20).

⁴⁸ ICF, 2024n. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-455A (Solstice® L40X).

⁴⁹ ICF, 2024o. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-457A (Forane® 457A).

⁵⁰ ICF, 2024p. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-516A (Forane® 516A).

not expected to present a flammability concern provided the use conditions are followed. The use conditions provide additional safety measures and labeling requirements (e.g., visible warning statement and red coloring on the pipes, hoses, and devices which contain refrigerant) that make equipment owners, consumers, fire marshals, and emergency first responders aware of the presence of a flammability hazard.

Toxicity and exposure data: HFC-32 and R-454B have an ASHRAE toxicity classification of A. Potential health effects of exposure to these refrigerants include drowsiness or dizziness. The refrigerants may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the refrigerants may cause irregular heartbeat. The refrigerants could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

AIHA has established a WEEL of 1,000 ppm (8-hr TWA) for HFC-32 and a WEEL of 500 ppm as an 8-hr TWA for HFO-1234yf, the components of R-454B. The manufacturer of R-454B recommends an AEL for the workplace of 854 ppm on an 8-hr TWA for this blend, as does ASHRAE 34-2022. EPA anticipates that users will be able to meet the AIHA WEELs and the manufacturer's AEL and address potential health risks by following requirements and recommendations in the manufacturers' SDS, the final use conditions (including adherence to UL 60335-2-89 and ASHRAE Standard 15), and other safety precautions common to the refrigeration and AC industry.

Comparison to other substitutes in this end-use: HFC-32, HFO-1234yf, and the refrigerant blends R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A all have an ODP of zero, comparable to or lower than some of the acceptable substitutes in new commercial ice machines, such as HFC-134a, R-410A, and R-513A, with ODPs of zero.

HFO-1234yf has a GWP of one, comparable to that of R-290 and ammonia with GWPs of three and zero. R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A have GWPs ranging from 140 to 465, higher than some of the acceptable substitutes for new commercial ice machines and lower than those of other substitutes such as R-450A and R-513A, with GWPs of about 600 and 630. HFC-32 has a GWP of 675, higher than some of the acceptable substitutes including R-290, R-450A, and R-513A; however, the GWP of HFC-32 is lower than those of R-410A and R-404A, with GWPs of approximately 2,090 to 3,920, which are refrigerants that have typically been

employed in larger systems. Our evaluation is that the characteristics of HFC-32, R-454A, and R-454B meet the technical needs of larger commercial ice machines, providing larger charge sizes, greater capacity and no glide, allowing for even formation of ice, while lower-GWP alternatives do not. For instance, R-513A and R-450A have lower capacity than HFC-32, and R-290 is restricted to smaller charge sizes (see section II.D of this preamble for further information). Remote appliances using A2L refrigerants, including remote condensers, may be either self-contained or field erected and may be factory or field charged.

Information regarding the toxicity of other available alternatives is provided in the previous listing decisions for new commercial ice machines (<https://www.epa.gov/snap/substitutes-commercial-ice-machines>). Toxicity risks of use, determined by the likelihood of exceeding the exposure limit of HFC-32, HFO-1234yf, and the refrigerant blends in these end-uses are evaluated in the risk screens referenced previously. The toxicity risks of using HFC-32, HFO-1234yf, and the refrigerant blends in new commercial ice machines are comparable to or lower than toxicity risks of other available substitutes in the same end-use. Toxicity risks of the listed refrigerants can be mitigated by use consistent with UL 60335-2-89 and ASHRAE 15-2022—which are required by our final use conditions—and other industry standards; recommendations in the manufacturers' SDS; and other safety precautions common in the refrigeration and AC industry.

The flammability risks of HFC-32, HFO-1234yf, and the refrigerant blends R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A in the new commercial ice machine end-use, determined by the likelihood of exceeding their respective LFLs, are evaluated in the risk screens referenced previously in this section. While these refrigerants pose greater flammability risk than other available, non-flammable substitutes in the new commercial ice machines end-use, this risk can be mitigated by use consistent with ASHRAE 15-2022 and UL 60335-2-89, required as use conditions in this rule, as well as recommendations in the manufacturers' SDS and other safety precautions common in the refrigeration and AC industry. EPA is requiring use conditions to reduce the potential risk associated with the flammability of these alternatives so that they will not pose greater overall risk to human health and the environment than other

acceptable substitutes in the new commercial ice machines end-use.

In addition, the listed refrigerants have lower GWPs than most other available alternatives for new commercial ice machines. The listing of these refrigerants provides additional lower-GWP options for situations where other refrigerants with lower GWPs are not viable, such as for use of HCs in systems with remote compressors or equipment requiring larger charge sizes, where equipment using CO₂ may not be able to meet energy conservation standards from the DOE, or where a refrigerant must have minimal glide to ensure consistent freezing while manufacturing ice. Given the wide range of applications and exacting performance requirements for commercial ice machines, not all refrigerants listed as acceptable under SNAP will be suitable for the range of equipment in new commercial ice machines. To provide additional options to ensure the availability of refrigerants with lower GWPs for the full range of new commercial ice machines and, therefore, lower overall risk to human health and the environment, EPA is listing HFO-1234yf and the refrigerant blends R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in all types of new commercial ice machines. Further, EPA is listing HFC-32, R-454A, and R-454B as acceptable, subject to use conditions, in larger commercial ice machines: specifically, remote commercial ice machines, self-contained batch-type commercial ice machines with a harvest rate greater than 1,000 lb ice per 24 hours, and self-contained continuous-type commercial ice machines with a harvest rate above 1,200 lb ice per 24 hours. EPA is not finalizing listings for those three refrigerants for smaller self-contained commercial ice machines at this time, as lower-GWP refrigerants, such as R-290, perform adequately. Further, EPA notes that in the final Technology Transitions Rule under the AIM Act, smaller self-contained commercial ice machines, namely, batch-type self-contained units with a harvest rate at or below 1,000 lb ice per 24 hours and continuous-type self-contained units with a harvest rate at or below 1,200 lb ice per 24 hours, are restricted to using refrigerants with a GWP less than 150.

4. Why is EPA finalizing these specific use conditions?

The use conditions identified in these final listings are explained in section II.H.1 of this preamble in greater detail.

5. What additional information is EPA including in these listings?

EPA is providing additional information related to these listings. Since this additional information is not part of the regulatory decision under SNAP, these statements are not binding for use of the substitute under the SNAP program. 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 refrigerants. See section II.H.2 of this preamble for further discussion on what additional information EPA is including in these listings.

6. How is EPA responding to comments on commercial ice machines?

Comment: One commenter recommended that EPA restrict acceptable substitutes in commercial ice machines to those below a 150 GWP limit. The reason for this commenter's request was to align with GWP limits in the proposed Technology Transition rulemaking, which, as proposed, would set a January 1, 2025, compliance date limiting refrigerants over a GWP of 150 for self-contained commercial ice machines with a charge of 500 grams or less. They noted the proposed SNAP Rule 26's inclusion of HFC-32, R-454A, and R-454B for use in commercial ice machines would conflict with the proposed Technology Transitions Rule, which would restrict the GWP of refrigerants below 150 in self-contained commercial ice machines with a charge size less than 500 g. The commenter pointed out that low-GWP refrigerants like carbon dioxide and R-717 would still be available for use in this subsector. The commenter opposed the addition of any refrigerants with a GWP of greater than 150, as required under the proposed Technology Transitions Rule, including R-454A in self-contained equipment.

Response: In this final rule, EPA is listing HFC-32, R-454A, and R-454Bx as acceptable, subject to use conditions, for remote condensing and larger self-contained commercial ice machines and is listing HFO-1234yf, R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for all commercial ice machines. The Agency is aware that commercial ice machine manufacturers have found it difficult to design for the use of alternative refrigerants with a GWP less than 150 (like carbon dioxide and R-717) that have adequate performance properties (e.g., sufficiently high pressure and volumetric capacity and a lower boiling

point) for use with larger equipment (i.e., with a larger ice harvest rate) or with a remote condenser; thus, EPA is listing three refrigerants as acceptable in this rule that have a GWP of greater than 150 that equipment manufacturers have been testing for use in commercial ice machines (i.e., HFC-32, R-454A, and R-454B). These three refrigerants have GWPs of 237 for R-454A, 465 for R-454B, and 675 for HFC-32, which are still lower than or comparable to refrigerants such as R-450A or R-513A, with GWPs of approximately 600 and 630. Further, their GWPs are significantly lower than commonly used HFC blends such as R-410A with a GWP of 2,090 and R-404A with a GWP of 3,920.

In response to comments related to the Technology Transitions Rule, as noted previously in this preamble, EPA agrees that there may be circumstances where there is little practical value in finalizing an acceptable listing for an alternative where the Technology Transitions Rule would restrict its use. However, that is not the situation here for this listing for R-454A with a GWP of 237, R-454B with a GWP of 465, and HFC-32 with a GWP of 675, for use in remote condensing and larger self-contained commercial ice machines. The Agency notes that the final Technology Transitions Rule categorizes self-contained commercial ice machines differently than in the proposed Technology Transitions Rule. EPA restricted refrigerants to those with a GWP of less than 150 for self-contained commercial ice machines with a harvest rate less than or equal to 1,000 or 1,200 pounds of ice per 24 hours (depending on whether the equipment was batch-type or continuous-type). Self-contained commercial ice machines with greater harvest rates are restricted from using certain higher-GWP HFC blends under that rule, but the refrigerants being listed in this final SNAP rule are not otherwise prohibited under the final Technology Transitions Rule. EPA did not propose, and is not finalizing in this action, a use condition restricting the use of those refrigerants that have a GWP of 150 or greater (i.e., HFC-32, R-454A, and R-454B). While EPA is not finalizing such a restriction in this action, in the future, EPA may consider further whether such a restriction would be appropriate under SNAP. EPA additionally notes, however, those refrigerants are still prohibited under the final Technology Transition rule for self-contained commercial ice machines with harvest rates less than or equal to 1,000 or 1,200 pounds per day.

D. Commercial Ice Machines—Revision of the Use Conditions in the Previous Listing of R-290 as Acceptable, Subject to Use Conditions, for Use in New Self-Contained Commercial Ice Machines

EPA is revising use conditions in the existing listing of R-290 as acceptable, subject to use conditions, for use in new self-contained commercial ice machines established in SNAP Rule 21 (81 FR 86779, December 1, 2016). In this final rule, we are updating those use conditions to be consistent with the most recent U.S. national industry safety standard for commercial refrigeration equipment, including self-contained commercial ice machines, UL 60335-2-89. Among other things, these revisions will allow safe use of larger charge sizes of R-290 than under the previous use condition requiring an earlier standard, UL 563, which will allow for broader use of R-290 as an alternative in this end-use. Similar use conditions apply to other refrigerants with lower flammability in this SNAP action in section II.C of this preamble. The final use conditions are allowed for such equipment manufactured on or after the effective date of this final rule and do not apply to nor affect equipment manufactured before that effective date.

This revision to the use conditions incorporates by reference a newer industry standard, changing the reference from Supplement SA to the 8th edition, dated July 31, 2009, of UL 563, "Ice Makers" to UL 60335-2-89. EPA is providing a transition period during which self-contained commercial ice machines manufactured with R-290 may follow either UL 563 or UL 60335-2-89. After the transition period ends, new self-contained commercial ice machines manufactured with R-290 must follow UL 60335-2-89 for purposes of the SNAP program, except as noted below for models that remain essentially unchanged from their earlier UL certification to UL 563.

Several use conditions finalized for this end-use are similar to those finalized for other end-uses. Because of this similarity, EPA discusses the use conditions that apply to all five end-uses in section II.H of this preamble. In summary, the common use conditions are: restricting the use of the refrigerant to new equipment that is specifically designed and clearly marked for that refrigerant; use consistent with ASHRAE 15-2022 and with UL 60335-2-89 including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and requirements for warning labels and markings on equipment to

inform consumers, technicians, and first responders of potential flammability hazards. The regulatory text of the use conditions appears in tables at the end of this document.

In this final action, EPA is revising the existing listing for R-290 in new self-contained commercial ice machines in appendix V to 40 CFR part 82, subpart G. The revised regulatory text contains listing decisions for new self-contained commercial ice machines in appendix V. EPA is also republishing certain other previous listings for purposes of formatting for the **Federal Register**; EPA is not finalizing substantive changes to those earlier decisions (*e.g.*, listings for R-290 in new water coolers and in new very low temperature refrigeration equipment).

1. Background on Commercial Ice Machines

See section II.C.1 of this preamble for background on this end-use.

2. What are the ASHRAE classifications for refrigerant flammability?

ASHRAE 34-2022 categorizes R-290 as being in the A3 Safety Group. See section II.A.2 of this preamble for further discussion on ASHRAE classifications.

3. What is R-290 and where is there information on its use in this end-use?

See section II.B.3 of this preamble for further discussion on the identity, environmental, flammability, toxicity, and exposure information for R-290.

Redacted submissions and supporting documentation for R-290 are provided in the docket for this final rule (EPA-HQ-OAR-2023-0043) at <https://www.regulations.gov>. EPA performed a risk screening assessment to examine the health and environmental risks of this refrigerant in self-contained commercial ice machines. The risk screen is available in the docket for this final rule.⁵¹

4. What existing use conditions apply to this refrigerant in this end-use?

EPA previously listed R-290 acceptable, subject to use conditions, in new self-contained commercial ice machines in SNAP Rule 21 (81 FR 86779, December 1, 2016). Those requirements are codified in appendix V to 40 CFR part 82, subpart G. EPA provided information on the environmental and health risks of R-290 and the various substitutes available at that time for use in this end-use. Additionally, EPA's previous risk screen

for this refrigerant, based on the use conditions in that rule, is available in the docket for that previous rulemaking (EPA-HQ-OAR-2015-0663).

R-290 has an ASHRAE classification of A3, indicating that it has low toxicity and higher flammability. In the presence of an ignition source (*e.g.*, static electricity, a spark resulting from a closing door, or a cigarette), an explosion or a fire could occur if the concentration of R-290 were to exceed the LFL of 21,000 ppm (2.1 percent) by volume.

The use conditions established in the 2016 listing for R-290 in new self-contained commercial ice machines addressed safe use of this flammable refrigerant and included the following: incorporation by reference of Supplement SA to the 8th edition (July 31, 2009, including revisions through November 29, 2013) of UL 563, "Ice Makers;" refrigerant charge size limits based on cooling capacity and type of equipment; and requirements for markings and warning labels on equipment using the refrigerant to inform consumers, technicians, and first responders of potential flammability hazards. Our assessment and listing decisions in SNAP Rule 21 (81 FR 86779, December 1, 2016) found that with the use conditions, the overall risk of this refrigerant, including the risk due to flammability, was not greater in this end-use than other substitutes that are currently or potentially available for that same end-use.

5. What updates to existing use conditions for commercial ice machines is EPA finalizing?

EPA is finalizing the proposed use conditions that apply to R-290 in new self-contained commercial ice machines manufactured on or after the effective date of this final rule. Several of the updated use conditions finalized for use of R-290 in self-contained commercial ice machines are common to those finalized for the stand-alone units end-use in section II.B of this preamble. Other use conditions are common to all refrigerants and all five end-uses in this final rule. Because of this similarity, EPA discusses the use conditions that apply to all five end-uses in section II.H of this preamble. For R-290 in self-contained commercial ice machines, these are the only revised use conditions EPA is finalizing. In summary, the common use conditions for all five end-uses are: restricting the use of the refrigerant to new equipment that is specifically designed and clearly marked for that refrigerant; use consistent with ASHRAE 15-2022 and with UL 60335-2-89 (with certain

exceptions), including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and requirements for warning labels and markings on equipment to inform consumers, technicians, and first responders of potential flammability hazards.

EPA is finalizing the use conditions in this action, which apply to new self-contained commercial ice machines manufactured on or after the effective date of this final rule. This final rule does not apply to nor affect equipment manufactured before that effective date. The final regulatory text presents these different requirements as numbered listings in separate table rows, where the end-use and the effective time period during which the equipment is manufactured are in the left-most column, with the heading "End-use"; the specific requirements are listed as use conditions in the fourth column, with the heading "Use Conditions." Under SNAP, EPA views equipment to be manufactured at the date upon which the appliance's refrigerant circuit is complete, the appliance can function, the appliance holds a full refrigerant charge, and the appliance is ready for use for its intended purposes. For new self-contained commercial ice machines, this occurs at the factory. New self-contained commercial ice machines manufactured using R-290 between January 3, 2017, and the effective date of this final rule are required to meet the use conditions in SNAP Rule 21 (which took effect January 3, 2017) and as listed in appendix V to 40 CFR part 82, subpart G (in listing 1), including the use condition incorporating by reference Supplement SA to the 8th edition of UL 563. Such products are permitted to be warehoused and sold through normal channels, even if they are sold after the effective date of this final rule. Self-contained ice machines using R-290 manufactured on or after the effective date of this final rule are required to meet the use conditions finalized and listed in the revisions to appendix V. Those use conditions allow manufacturers of new self-contained commercial ice machines using R-290 to follow either UL 563 or UL 60335-2-89, dependent upon which standard the equipment was manufactured, from the effective date of this final rule and will last through September 29, 2024, which is the date when UL is sunseting UL 563. On and after September 30, 2024, new self-contained commercial ice machines using R-290 for any new equipment designs or models must meet

⁵¹ ICF, 2023q. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: (R-290).

UL 60335-2-89; for an unchanged model or design that was already listed by UL—that is, already certified to meet the requirements of UL 563—it could continue to meet those requirements.

EPA is finalizing use conditions allowing all new self-contained commercial ice machines using R-290 to be manufactured consistent with Supplement SA of UL 563, up to and including September 29, 2024. Therefore, during the time between the effective date of this final rule and September 29, 2024, manufacturers may follow either UL 563, 8th edition or UL 60335-2-89, 2nd edition, depending on which standard the equipment was designed to. This transition date was in this rule's proposal in order to align with the industry standard sunset date for UL 563. It is EPA's understanding that since proposal, UL has discussed updating its effective date when UL 60335-2-89 replaces UL 563 to reflect a later continuing certification date. EPA is allowing manufacturers to adhere to either standard for this limited time because the Agency recognizes that manufacturers may need time to make necessary changes including to their product labels. The period during which manufacturers may follow either standard should provide sufficient time for manufacturers to transition from UL 563 to UL 60335-2-89 while designing and testing new models and designs. Beginning September 30, 2024, for the purposes of the SNAP program, newly manufactured self-contained commercial ice machines of new models and designs using R-290 must meet the requirements of UL 60335-2-89. Newly manufactured self-contained commercial ice machines of existing models and designs that are certified (e.g., UL-listed) using R-290 that remain unchanged other than cosmetic changes (e.g., color changes) and that meet Supplement SA of UL 563 prior to September 30, 2024, may continue to meet those requirements after that date. In addition, EPA is requiring manufacturers to follow the set of use conditions that correspond with a specific UL standard (e.g., EPA included text in the revisions to appendix V stating that when an entity is using UL 563, it is to follow all use conditions in listing 1 and when using UL 60335-2-89, it is to follow all use conditions in listing 3 in the final revisions to appendix V). See section II.H.1 of this preamble for further discussion on the requirements of UL 60335-2-89, 2nd edition, which EPA is incorporating by reference.

EPA also notes that we are continuing to apply without revision two existing use conditions, nor did we take

comment on those two existing use conditions. The use conditions that restrict the use of R-290 to new equipment specifically designed for this refrigerant, and that require red-colored markings at service ports, pipes, hoses, and other devices through which the refrigerant is serviced, are existing use conditions for R-290 in new self-contained commercial ice machines.

6. How do the new use conditions for commercial ice machines differ from the existing ones and why is EPA changing the use conditions?

The revised use conditions EPA is finalizing for self-contained commercial ice machines are similar to the ones that exist today in appendix V to 40 CFR part 82, subpart G, for R-290 in this end-use. The existing requirements that R-290 must be used in new equipment only and that new self-contained commercial ice machines must include red markings at service ports, pipes, hoses, and other devices through which the refrigerant is serviced, are repeated in this final listing. The revised use conditions concern incorporating by reference the most recent U.S. industry standard for commercial ice machines and labeling requirements consistent with that new standard. Self-contained commercial ice machines using R-290 manufactured before the effective date of this final rule are not affected by the revised use conditions.

Warning labels are required under EPA's existing regulations, and EPA is continuing to require them, although with some specific language changes. The finalized warning labels are identical to those previously required as use conditions for the use of R-290 in self-contained commercial ice machines. Using a common set of labels, like those in UL 60335-2-89, aids in compliance and could reduce burden for the industry, especially for a manufacturer that uses more than one refrigerant. EPA is finalizing that the labels must be provided in letters no less than 6.4 millimeter ($\frac{1}{4}$ inch) high and must be permanent, which is identical to the existing requirement for R-290 in self-contained commercial ice machines.

EPA is incorporating by reference a newer industry standard in the use conditions, including use of UL 60335-2-89, 2nd edition, instead of continuing to require the standard Supplement SA of the 8th edition of UL 563 for equipment manufactured on or after the effective date of this final rule. UL 60335-2-89 was developed in an open and consensus-based approach, with the assistance of experts in the refrigeration and AC industry as well as experts

involved in assessing the safety of products. The revision cycle for the 2nd edition, including final recirculation, concluded with its publication on October 27, 2021. The 2021 standard UL 60335-2-89 replaces the previously published version of several standards, including UL 563, which had already been revised into an 8th edition by that time. EPA is aware of the continuing progress of UL standards to address flammable refrigerants. Today, we are finalizing such a change knowing that UL is replacing the standard to which such equipment is UL-listed from UL 563 to the newer UL 60335-2-89 as of September 30, 2024.

To allow time for manufacturers of self-contained commercial ice machines to transition between the existing use condition using the 8th edition of UL 563 and the new use condition using UL 60335-2-89, EPA is allowing R-290 to be used in self-contained commercial ice machines manufactured either following UL 563 or UL 60335-2-89 during a transition period. That transition period begins on the effective date of this final rule and lasts through September 29, 2024. It is EPA's understanding that UL intends to sunset UL 563 on September 29, 2024, and EPA is coordinating with that sunset date. Further, based on public comments, EPA understands that UL allows newly manufactured equipment that remains unchanged from its previous UL-listed (certified) design or model to continue to follow an earlier standard such as UL 563 because the manufacturer has made no changes. EPA is adopting a similar approach, as well, in this final rule. Beginning September 30, 2024, the use condition allows R-290 to be used in new self-contained commercial ice machines that follow UL 60335-2-89 or in newly manufactured stand-alone units that are unchanged from the model or design previously UL-listed as meeting UL 563, 8th edition. In addition, manufacturers must follow the set of use conditions that correspond with a specific UL standard (i.e., when using UL 563, follow all use conditions in listing 1 and when using UL 60335-2-89, follow all use conditions in listing 3 in the final revisions to appendix V of part 82, subpart G).

Another revision to the use conditions is the limit on charge sizes. The existing use conditions from SNAP Rule 21 require charge sizes to be calculated consistent with UL 563, with a maximum charge size of 150 g allowed. The final revised use conditions for equipment manufactured on or after the effective date of this final rule allow charge sizes calculated based on UL 60335-2-89, which allows charge sizes

of R-290 up to approximately 500 g for open equipment, 300 g for equipment with doors or drawers, or 115 g for equipment near a pathway for egress. These changes allow the use of R-290 in larger equipment than previously and provide more options for industry, while maintaining environmental health and human safety.

Because of the differences between UL 563 and UL 60335-2-89, EPA performed a new risk screen for R-290 as a refrigerant in self-contained commercial ice machines.⁵² In this risk screen, EPA adjusted charge sizes to be consistent with the larger charge sizes allowed for R-290 under UL 60335-2-89. The risk screen also considered the impact of mitigation methods such as valves that would restrict the amount of refrigerant that could be released. The updated risk screen found that concentrations of R-290 still would not exceed the LFL when used according to the new use condition with releasable charges and larger charge limits and consistent with UL 60335-2-89, and thus the new use conditions also address flammability risks of using R-290.⁵³ In addition, the risk screen modeled the reasonable worst-case scenario of short-term exposure (15-minute TWA) due to a catastrophic release of the charge. Under this highly conservative scenario, the worst-case exposure was still significantly lower than the ATEL of 50,000 ppm.⁵⁴ For further information, see the risk screen⁵⁵ for R-290 in self-contained commercial ice machines in the docket for this rulemaking.

7. What additional information is EPA including in this listing?

EPA is providing additional information related to this final listing. Since this additional information is not part of the regulatory decision under SNAP, these statements are not binding for use of the substitute under the SNAP program. 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 refrigerants. See section II.H.2 of this preamble for further discussion on what additional information EPA is including in these listings. EPA notes that the additional information is similar to, but not identical with, the additional information in the listing for R-290 in self-contained commercial ice machines

in SNAP Rule 21. EPA is finalizing additional information to that included in the listings for R-290 in self-contained commercial ice machines in SNAP Rule 21.

8. How is EPA responding to comments on listing R-290 and updating the use conditions for R-290 in self-contained commercial ice machines?

Comment: One commenter expressed that EPA should not allow for the use of R-290 in commercial ice machines with remote compressors that are not self-contained due to flammability concerns. Specifically, the commenter stated that the use of R-290 is restricted in UL 60335-2-89 to self-contained equipment to lessen the risks associated with higher flammability refrigerants.

Response: EPA agrees with the commenter that R-290 should not be allowed in commercial ice machines with remote compressors that are not self-contained due to flammability concerns. The 2nd edition of UL 60335-2-89 limits the use of R-290 to self-contained commercial ice machines, and that standard does not allow for use of R-290 in commercial ice machines with remote compressors. EPA is finalizing use conditions for R-290 in this final rule that are consistent with using R-290 only in self-contained commercial ice machines and is not listing R-290 as acceptable in commercial ice machines with remote compressors.

Comment: Two commenters suggested clarifications surrounding manufacturers' use of R-290 in self-contained products (150 grams or less). They noted that UL will allow manufacturers to continue under UL 563 requirements until a significant product change is made or the manufacturer withdraws their file. The commenters stated that only at that time will R-290 equipment become subject to 60335-2-89. They asked for EPA to clarify this in the final rule.

Response: EPA addressed a similar comment with respect to refrigerated food processing and dispensing equipment end-uses in section II.B.10 of this preamble. Those reasons are also applicable to this end-use and for the same reasons, EPA is finalizing an end-use description and use conditions for R-290 in this final rule that are consistent with using R-290 only in self-contained commercial ice machines and not in commercial ice machines with remote compressors.

E. Industrial Process Refrigeration—Listing of HFC-32, HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A as Acceptable, Subject to Use Conditions, for Use in New Industrial Process Refrigeration

This final rule lists HFC-32, HFO-1234yf, HFO-1234ze(E), and the refrigerant blends R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new IPR equipment. HFO-1234yf, HFO-1234ze(E), and the refrigerant blends R-454C, R-455A, R-457A, and R-516A are being listed for all IPR equipment including both chillers and non-chiller—e.g., direct expansion (DX)—IPR equipment. The listings for refrigerants HFC-32, R-454A, and R-454B are being finalized in this rule only for chillers for IPR and for DX IPR equipment where the temperature of the refrigerant entering the evaporator is less than or equal to $-30\text{ }^{\circ}\text{C}$ and for R-454A, also may be used in DX IPR equipment with a refrigerant charge capacity less than 200 pounds or in the high-temperature side of a cascade system with the refrigerant temperature entering the evaporator higher than $-30\text{ }^{\circ}\text{C}$. EPA is not finalizing listings for those three refrigerants for other IPR uses at this time. EPA is modifying the proposed use conditions for R-454A, R-454B, and HFC-32 to also allow these substitutes in direct expansion IPR equipment with refrigerant entering the evaporator at temperatures less than or equal to $-30\text{ }^{\circ}\text{C}$, based on public comment regarding the limited availability of substitutes for this particular temperature range and based upon our comparative risk analysis concluding that these substitutes for these specific uses and use conditions are not expected to pose greater risk to overall health or the environment. EPA is not reaching a final decision in this rule on these refrigerants for other IPR uses for HFC-32 and R-454B (i.e., for DX IPR equipment with the refrigerant temperature entering the evaporator higher than $-30\text{ }^{\circ}\text{C}$).

Most of the use conditions finalized for the A2L refrigerants when used in IPR are the same as those finalized for other end-uses. Because of this similarity, EPA discusses the use conditions that apply to all five end-uses in section II.H of this preamble. In summary, the common use conditions are: restricting the use of each refrigerant to new equipment that is specifically designed and clearly marked for that refrigerant; use consistent with ASHRAE 15-2022 and

⁵² ICF, 2024q. *Op. cit.*

⁵³ *Ibid.*

⁵⁴ *Ibid.*

⁵⁵ *Ibid.*

with UL 60335-2-89 (with certain exceptions), including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and requirements for warning labels and markings on equipment to inform consumers, technicians, and first responders of potential flammability hazards.

In addition to the common use conditions discussed in section II.H of this preamble, the following use condition also applies to HFC-32 and R-454B in IPR: these refrigerants may only be used in IPR: (1) For chillers or (2) for equipment that is not a chiller with the refrigerant temperature entering the evaporator is less than or equal to -30°C .

The following use condition also applies for R-454A in IPR: this substitute may only be used in IPR (1) for chillers, (2) equipment with the refrigerant temperature entering the evaporator less than or equal to -30°C , (3) equipment with a refrigerant charge capacity less than 200 pounds and with the refrigerant temperature entering the evaporator higher than -30°C (-22°F), and (4) in the high-temperature side of a cascade system with the refrigerant temperature entering the evaporator higher than -30°C .

The regulatory text of the final decisions appears in tables at the end of this document and is being codified in appendix Y to 40 CFR part 82, subpart G. The final regulatory text contains listing decisions for the end-use discussed in this section. EPA notes that there may be other legal obligations pertaining to the manufacture, use, handling, and disposal of these refrigerants that are not included in the information listed in the tables (e.g., the CAA section 608(c)(2) venting prohibition or DOT requirements for transport of flammable gases). Flammable refrigerants being recovered or otherwise disposed of from IPR equipment are likely to be hazardous waste under RCRA (see 40 CFR parts 260 through 270).

1. Background on Industrial Process Refrigeration

IPR systems cool process streams in industrial applications, for example, machining of metal products, fermentation of beer, or operation of hydraulic circuits. The choice of refrigerant for specific applications depends on ambient and required operating temperatures and pressures. It is EPA's understanding that this type of equipment may fall under the scope of ASHRAE 15-2022. This type of equipment also typically falls under the

scope of UL 60335-2-89, "Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor" if it is not used in an industrial occupancy⁵⁶ and that it always falls under ASHRAE 15. In contrast, industrial process air conditioning primarily cools people, although it may also cool processes, and follows a different UL standard (UL 60335-2-40). When chillers are used primarily to cool process streams, rather than for comfort cooling, SNAP describes this application as "chillers in IPR."

2. What are the ASHRAE classifications for refrigerant flammability?

ASHRAE 34-2022 categorizes the refrigerants listed for IPR in this section as being in the A2L Safety Group. See section II.A.2 of this preamble for further discussion on ASHRAE classifications.

3. What are HFC-32, HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A and how do they compare to other refrigerants in the same end-use?

See sections II.A.3 and II.C.3 of this preamble for further discussion on the environmental, flammability, toxicity, and exposure information for these refrigerants.

The redacted submission and supporting documentation for HFC-32, HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A is provided in the docket for this rule (EPA-HQ-OAR-2023-0043) at <https://www.regulations.gov>. EPA performed risk screening assessments to examine the health and environmental risks of these refrigerants. These risk screens are available in the docket for this rule.^{57 58 59 60 61 62 63 64 65}

⁵⁶ ASHRAE 15-2022 defines industrial occupancy as, "a premise or that portion of a premise that is not open to the public, where access by authorized persons is controlled, and that is used to manufacture, process, or store goods such as chemicals, food, ice, meat, or petroleum."

⁵⁷ ICF, 2023r. Risk Screen on Substitutes in Industrial Process Refrigeration (New Equipment); Substitute: HFC-32 (Difluoromethane).

⁵⁸ ICF, 2023s. Risk Screen on Substitutes in Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks (New Equipment); Substitute: HFO-1234yf.

⁵⁹ ICF, 2023t. Risk Screen on Substitutes in Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks (New Equipment); Substitute: HFO-1234ze(E) (Solstice[®] ze, Solstice[®] 1234ze).

⁶⁰ ICF, 2023u. Risk Screen on Substitutes in Industrial Process Refrigeration and Cold Storage Warehouses (New Equipment); Substitute: R-454A (Opteon[®] XL40).

⁶¹ ICF, 2023v. Risk Screen on Substitutes in Industrial Process Refrigeration (New Equipment); Substitute: R-454B (Opteon[®] XL41).

Comparison to other substitutes in this end-use: HFC-32, HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A all have an ODP of zero, comparable to or lower than some of the acceptable substitutes in new IPR equipment, such as HFC-134a, R-410A, and R-513A with ODPs of zero and hydrochlorofluoroolefin (HFCO)-1233zd(E) with an ODP less than 0.0004.⁶⁶

HFO-1234yf and HFO-1234ze(E) both have a GWP of one, comparable to that of R-290 and ammonia with GWP of three and zero. R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A have GWPs ranging from 140 to 470, higher than some of the acceptable substitutes for new IPR equipment, including R-290 and ammonia, and lower than those of other substitutes such as R-450A and R-513A with GWPs of about 600 and 630. HFC-32, which EPA is restricting to use in chillers for IPR or in IPR equipment with the refrigerant temperature entering the evaporator is less than or equal to -30°C , has a GWP of 675, which is higher than some of the acceptable substitutes including R-290, R-450A, and R-513A; however, the GWP of HFC-32 is lower than those of R-410A and R-404A, with GWPs of approximately 2,090 to 3,920, which are refrigerants that have typically been employed in chillers for IPR, but as of January 1, 2026 or January 1, 2028, depending on the temperature range, will be subject to restrictions in new IPR systems under the Technology Transitions Rule. In light of that upcoming restriction, EPA is listing HFC-32 and R-454B to provide additional lower-GWP, low-temperature refrigerants in these end-uses. This upcoming restriction, and the corresponding value of providing additional lower-GWP, low temperature refrigerants in these end-uses, are additional considerations that informed EPA's decision on this listing.

Information regarding the toxicity of other available alternatives is provided

⁶² ICF, 2023w. Risk Screen on Substitutes in Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks (New Equipment); Substitute: R-454C (Opteon[™] XL20).

⁶³ ICF, 2023x. Risk Screen on Substitutes in Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks (New Equipment); Substitute: R-455A (Solstice[®] L40X).

⁶⁴ ICF, 2023y. Risk Screen on Substitutes in Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks (New Equipment); Substitute: R-457A.

⁶⁵ ICF, 2023z. Risk Screen on Substitutes in Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks (New Equipment); Substitute: R-516A.

⁶⁶ WMO, 2022.

in the previous listing decisions for new IPR equipment (<https://www.epa.gov/snap/substitutes-industrial-process-refrigeration>). Toxicity risks of use, determined by the likelihood of exceeding the exposure limits of HFC-32, HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A in this end-use, are evaluated in the risk screens referenced previously. The toxicity risks of using HFO-1234yf and the refrigerant blends in IPR, and of using all nine refrigerants in chillers for IPR, are comparable to or lower than toxicity risks of other available substitutes in the same end-use. Toxicity risks of these refrigerants can be mitigated by use consistent with ASHRAE 15-2022 and other industry standards, recommendations in the manufacturers' SDS, and other safety precautions common in the refrigeration and AC industry.

The flammability risks with HFC-32, HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A in the IPR end-use, determined by the likelihood of exceeding their respective LFLs, are evaluated in the risk screens referenced in this section. While these refrigerants may pose greater flammability risk than available substitutes in the new IPR end-use that are non-flammable, this risk can be mitigated by use consistent with ASHRAE 15-2022 and, if applicable, UL 60335-2-89, as required by our use conditions, as well as recommendations in the manufacturers' SDS and other safety precautions common in the refrigeration and AC industry. We also note that other acceptable refrigerants in the IPR end-use have higher flammability and are classified in the A3 Safety Group, such as R-290, butane (R-600), and propylene (R-1270). EPA is finalizing use conditions to reduce the potential risk associated with the flammability of the alternatives so that they will not pose greater overall risk to human health and the environment than other acceptable substitutes for new equipment in the IPR end-use.

In addition, the listed substitutes have lower GWPs than most other available alternatives for the same uses. The listed refrigerants may provide additional lower-GWP options for situations where other refrigerants with lower GWPs are not viable, such as situations where sparks or flame might occur such that HCs are not suitable for use, or for systems with remote compressors or equipment requiring larger charge sizes, where refrigerant leaks are more likely to create greater flammability risk. Given the wide range of applications for IPR, not all refrigerants listed as acceptable under SNAP will be suitable

for the range of equipment in the IPR end-use. To provide additional options to ensure the availability of refrigerants with lower GWPs for the full range of IPR equipment and, therefore, lower overall risk to human health and the environment, EPA is listing HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in IPR.

EPA is also listing the refrigerants HFC-32 and R-454B with a use condition restricting their use to chillers in IPR or in IPR equipment with the refrigerant temperature entering the evaporator is less than or equal to -30°C . These refrigerants have higher GWPs than the other refrigerants EPA is listing as acceptable, subject to use conditions, but lower GWPs than many refrigerants typically used today in chillers for IPR, such as R-410A and R-404A, with GWPs of 2,090 and 3,290 respectively (but will be restricted as soon as January 1, 2026). These refrigerants also have lower flammability than HC refrigerants currently listed as acceptable in IPR. In light of upcoming restrictions under the Technology Transitions Rule, EPA is listing additional substitutes for use in these end-uses. The Agency expects that these refrigerants may provide additional, lower-GWP options for chillers for IPR, where greater volumetric capacity and higher operating pressures may be required to operate properly than for other types of IPR equipment (e.g., direct expansion systems), to address applications where other substitutes with lower GWPs may not be technically feasible, safe to human health, or environmentally suitable. In addition, these refrigerants may provide additional, lower-GWP options for IPR equipment where the temperature of the refrigerant needs to attain temperatures less than or equal to -30°C ; fewer refrigerants have boiling points low enough to achieve these lower temperatures, and thus, EPA is also finalizing listings for HFC-32 and for R-454B, with boiling points of -51.9°C and -51°C , respectively, to provide additional options.

EPA is also listing the refrigerant R-454A with a use condition that this substitute may only be used either in chillers for IPR, in equipment with a refrigerant charge capacity less than 200 pounds, in the high-temperature side of a cascade system, or in IPR equipment with the refrigerant entering the evaporator is less than or equal to -30°C . This refrigerant may provide additional, lower-GWP options for chillers for IPR, where greater volumetric capacity and higher operating pressures may be required to

operate properly than for other types of IPR equipment. R-454A may also address the additional challenges for finding lower-GWP refrigerants with higher capacity for non-chiller IPR equipment with moderate charge sizes and for cascade systems; hence, EPA is listing R-454A as acceptable, subject to use conditions, for use in new non-chiller IPR equipment with a charge size capacity less than 200 pounds or for use in the high-temperature side of a cascade system. In addition, these refrigerants may provide additional, lower-GWP options for IPR equipment where the temperature of the refrigerant needs to attain temperatures less than or equal to -30°C ; fewer refrigerants have boiling points low enough to achieve these lower temperatures, and thus, EPA is also finalizing a listing for R-454A in IPR equipment with the refrigerant temperature entering the evaporator is less than or equal to -30°C (with a boiling point of -48°C) to provide additional options.

4. Why is EPA finalizing these specific use conditions?

The final use conditions identified in the listings for all nine refrigerants are explained in the preceding paragraphs and in section II.H.1 of this preamble.

EPA is finalizing the use conditions for HFC-32 and R-454B restricting their use to chillers for IPR or in IPR equipment with the refrigerant temperature entering the evaporator is less than or equal to -30°C because these refrigerants have higher GWPs than many of the available substitutes in IPR (e.g., HCs, HFOs); however, because chillers may require greater volumetric capacity than other types of IPR equipment (e.g., DX systems), and because some IPR applications require temperatures below -30°C , EPA is listing these two additional refrigerants to provide additional lower-GWP options that pose lower overall risk to human health and the environment than other available substances and to address a broader range of equipment and applications. EPA also is finalizing a use condition for R-454A that allows its use in chillers for IPR or in IPR equipment with the refrigerant temperature entering the evaporator is less than or equal to -30°C , as well as other certain other applications, as described in this section. In addition, EPA is listing HFC-32, R-454A, and R-454B as acceptable, subject to use conditions, for chillers because of technical limitations, such as volumetric capacity, operating pressure, and temperature range, which restrict the technical viability of some other safe and environmentally suitable

alternatives for some applications. The Agency previously listed these three refrigerants as acceptable, subject to use conditions, in centrifugal and positive displacement chillers for comfort cooling in SNAP Rule 25 because of the same technical concerns and with the same use conditions as EPA is finalizing here. In addition, these use conditions are consistent with restrictions on refrigerants that contain HFCs under the final Technology Transitions Rule, allowing for greater consistency and reducing potential confusion for the regulated community.

EPA is finalizing the use condition for R-454A, restricting its use to chillers for IPR, equipment with a refrigerant charge capacity less than 200 pounds, the high-temperature side of a cascade system, or IPR equipment with the refrigerant temperature entering the evaporator is less than or equal to -30°C . EPA is listing R-454A for use in chillers for IPR and in IPR equipment with the refrigerant temperature entering the evaporator is less than or equal to -30°C for the same reasons as for HFC-32 and R-454B. The Agency is also finalizing this use condition to allow use of R-454A less broadly than for the refrigerants HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A because its GWP is higher than those other listed refrigerants for non-chiller IPR equipment (R-454A has a GWP of about 237, compared to one to 150).

EPA's understanding is that, in addition to the technical constraints for refrigerant in chillers for IPR, there are two more situations where use of refrigerants is likely to be more constrained, and thus, additional refrigerant options that reduce overall risk to human health and the environment may be helpful. The first of those situations is where ASHRAE 15-2022 identifies a refrigerating system as having a "high probability" that leaked refrigerant from a failed connection, seal, or component could enter an occupied area. UL 60335-2-89 effectively sets charge limits for A2L refrigerants to 260 times the LFL for applications inside an occupied space where people might be located. This amount is approximately 200 pounds, depending on the LFL of the particular refrigerant. In contrast, larger charge sizes in equipment meeting the requirements of ASHRAE 15 could be used in "low-probability" locations where the general public is unlikely to come in contact with the refrigerant, such as systems used in industrial occupancies, outdoors, or in a machinery room with access restricted to facility employees. Where the general

public is unlikely to come into contact with any leaked refrigerant, there would be fewer space constraints and greater flexibility in equipment design, so refrigeration system designers can accommodate a narrower set of refrigerants. Conversely, where people are more likely to come into contact with any leaked refrigerant in an interior space, which are not industrial occupancies, refrigerant charge capacities of a system would be less than 200 pounds. In addition, in such public spaces there would be more space constraints, less flexibility in equipment design, and potentially stricter code requirements. EPA recognizes that these may be situations where R-454A can be used where those other refrigerants cannot, especially where space is constrained. Therefore, R-454A fills a gap in the stated end-uses where lower-GWP refrigerant alternatives are not as available, and R-454A's GWP of approximately 237 and similar toxicity and flammability profiles would pose lower overall risk to human health and the environment than other available refrigerants. Therefore, EPA is listing R-454A as acceptable, subject to use conditions, for non-chiller IPR equipment with a refrigerant charge capacity less than 200 pounds (and with the refrigerant temperature entering the evaporator higher than -30°C).

The second situation where use of refrigerants is likely to be more constrained, and therefore where EPA is listing R-454A, is for use in the high-temperature side of cascade systems used for non-chiller IPR equipment (and with the refrigerant temperature entering the evaporator higher than -30°C). As discussed in section II.A.1 of this preamble, "Background on retail food refrigeration," each side of a cascade system uses a different refrigerant that is most suitable for the given temperature range. Higher temperature systems, or the "high-temperature side," have typically used HFCs as a refrigerant; however, it is technologically achievable and has become more common to use ammonia in the high-temperature side. For lower temperature systems, or the "low temperature side" of the cascade system, refrigerants with low boiling points such as R-744 can be used. Considerations for the choice of refrigerant on the high or low temperature side of cascade systems are influenced by many factors including, but not limited to, a refrigerant's toxicity and flammability, its temperature glide, and its suitability to lower temperature applications. There are a number of substitutes available for the low

temperature side of a cascade system with GWPs lower than that of R-454A. However, using flammable or toxic refrigerants, such as ammonia, on the high-temperature side of a cascade system may be limited in certain circumstances (e.g., based on building codes and/or industry safety standards). Therefore, EPA is listing R-454A as acceptable, subject to use conditions, when it is used in the high-temperature side of cascade systems (and with the refrigerant temperature entering the evaporator higher than -30°C). This action expands the lower-GWP refrigerant options that reduce overall risks to human health and the environment and that can comply with local building codes and industry safety standards while meeting the more challenging application of the high-temperature side of a cascade system.

5. What additional information is EPA including in these listings?

EPA is providing additional information related to these listings. Since this additional information is not part of the regulatory decision under SNAP, these statements are not binding for use of the substitute under the SNAP program. However, EPA encourages users of substitutes to apply all statements in the "Further Information" column in their use of these refrigerants. See section II.H.2 of this preamble for further discussion on what additional information EPA is including in these listings.

6. How is EPA responding to comments on industrial process refrigeration?

Comment: Three commenters addressed the use of R-454B and HFC-32 in the IPR end-use. These commenters claimed that R-454B and HFC-32 are needed for IPR beyond chillers and requested that EPA approve them for all IPR applications such as industrial, medical, and laboratory applications. They provided additional details that these refrigerants have lower boiling points than other proposed alternatives, which allows for lower evaporator temperatures needed for certain applications (e.g., blood and vaccine storage below -40°C). The commenters also stated that these refrigerants have low or no glide, which is important for lower-temperature IPR systems using flooded evaporators (not all of which are chillers). The commenters specified that such specialized equipment may not have other refrigerants with lower GWPs that are technically feasible. They also said that requiring high pressure low GWP substitutes, such as the other refrigerants under consideration in this

action, may damage systems. Therefore, they asserted that HFC-32 and R-454B are the only two low GWP refrigerants that will perform at the required conditions and above atmospheric pressure in certain applications. One commenter added that limiting R-454B and HFC-32 refrigerants to chillers for IPR would amount to imposing use conditions that are contrary to reducing the “overall risk to human health and the environment” as required under CAA section 612(c). The commenter noted that R-454B and HFC-32 have lower GWPs than many currently acceptable substances, and suggested approving these two refrigerants broadly for the IPR sector would help lower environmental impact compared to incumbent refrigerants in wide use. The commenter also claimed that EPA had not clearly described how it accounted for the benefits of HFC-32 and R-454B relative to incumbent refrigerants.

Response: While EPA is not granting the commenters’ request for listing R-454B and HFC-32 broadly for all IPR, including industrial, medical, and laboratory applications in IPR, we acknowledge that these refrigerants present advantages in performance for IPR operating at low temperatures. Therefore, based on comments received about the technological requirements for IPR to reach very cold temperatures, EPA is listing HFC-32 and R-454B as acceptable, subject to use conditions, for IPR, as proposed, with a use condition that provides for use in IPR chillers. EPA is also making a modification to the proposed use condition for HFC-32 and R-454B in IPR that would allow for use in non-chiller IPR with the refrigerant temperature entering the evaporator less than or equal to $-30\text{ }^{\circ}\text{C}$. EPA is achieving this by modifying the use condition for HFC-32 and R-454B in IPR, so that it provides for use of HFC-32 and R-454B in both chillers for industrial process refrigeration and in equipment with the refrigerant temperature entering the evaporator less than or equal to $-30\text{ }^{\circ}\text{C}$. While R-454B and HFC-32 have higher GWPs than the other refrigerants being listed as acceptable in this action, listing these two refrigerants as acceptable with use conditions that provide for use at lower temperatures still leads to lower risk to the environment and human health because these refrigerants are lower risk than what is currently in use.

The Agency is not at this time listing R-454B and HFC-32 as acceptable in all other IPR uses. We do not agree that commenters have demonstrated that other lower-risk, lower-GWP options are not available for other non-chiller IPR uses outside of the lower temperature

applications described in their comments. We also note that upcoming restrictions under the AIM Act’s Technology Transitions Rule will restrict the GWP of refrigerants used for non-chiller IPR to 150 to 700, depending on the temperature of the refrigerant entering the evaporator, the refrigerant charge capacity, and whether the refrigerant is used in the high-temperature side of a cascade system. Thus, regardless of EPA’s consideration under the CAA SNAP program, R-454B and HFC-32 could not be used in all IPR applications; their use would be restricted in certain applications under the AIM Act’s Technology Transitions Rule (88 FR 73098; October 24, 2023).

As noted, in response to comments, EPA is finalizing R-454B and HFC-32 as acceptable, subject to use conditions, in non-chiller IPR low temperature applications, specifically, equipment with the refrigerant temperature entering the evaporator is less than or equal to $-30\text{ }^{\circ}\text{C}$. These refrigerants have lower boiling points, as discussed previously in the comparison to other substitutes in this end-use, than the other refrigerants listed in this rule. The Agency recognizes that IPR equipment is often highly specialized and designed specifically for cooling a particular industrial process, and that certain specialized applications may require refrigerants operating at evaporator temperatures of $-40\text{ }^{\circ}\text{C}$ or lower. Other, lower-GWP refrigerants may not be feasible for use in such lower-temperature applications. EPA further notes that the final Technology Transitions Rule similarly accommodated lower-temperature IPR applications by establishing a higher GWP limit for IPR systems with the refrigerant temperature entering the evaporator less than or equal to $-30\text{ }^{\circ}\text{C}$. 88 FR at 73143.

In response to the comment comparing HFC-32 and R-454B to incumbent refrigerants, EPA notes that there are other acceptable refrigerants that reduce overall risks more than both HFC-32 and R-454B and the incumbent refrigerants in most DX IPR uses, such as ammonia, HCFO-1233zd(E), R-1224yd(Z), R-290, R-471A, and R-744. Thus, EPA does not agree with the commenter’s assertion that the use restriction for this listing for R-454B and HFC-32 increases overall risk to human health and the environment. Several of these substitutes are non-flammable or are comparable in flammability to HFC-32 and R-454B, such as ammonia, HCFO-1233zd(E), R-1224yd(Z), R-471A, and R-744. Most of those refrigerants contain compounds that are not VOC or are excluded from

EPA’s regulatory definition of VOC (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. Most have an ozone depletion potential of zero, comparable to HFC-32 and R-454B, with HCFO-1233zd(E) and R-1224yd having ODPs of less than 0.0004, and all have a GWP less than 150, compared to R-454B’s GWP of 470 and HFC-32’s GWP of 675. However, these lower-GWP refrigerants have boiling points that are too high to use in DX IPR equipment with the refrigerant temperature entering the evaporator less than or equal to $-30\text{ }^{\circ}\text{C}$ ($-22\text{ }^{\circ}\text{F}$), as discussed above in this response.

Comment: One commenter supported EPA’s proposed approval of HFC-32, HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A for new IPR equipment. The commenter stated that HFC-32, R-454A, and R-454B should be approved for use in IPR chillers to preserve as many refrigerant options as possible while navigating changes in equipment design and technology, despite their higher GWPs than other listed alternatives.

Response: EPA acknowledges the commenter’s support for listing HFC-32, HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A in this rulemaking. EPA agrees with the commenter that listing HFC-32, R-454A, and R-454B will provide more refrigerant options for chillers for IPR while industry navigates changes in equipment design and technology. EPA is listing HFC-32, HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A for use in chillers for IPR as proposed, among other things.

Comment: Two commenters suggested changes to the proposal to align with existing standards for the IPR sector. One commenter stated that very large systems located in industrial occupancies, refrigeration rooms, or machinery rooms do not fall under the listing nor installation requirements of UL 60335-2-89. Another commenter noted that manufacturers adhere to ASHRAE 15, American Society of Mechanical Engineers (ASME) b31.5, ASME b31.1, or IAR standards within the IPR sector depending on the specific application. The commenter requested that EPA consider for IPR, IPR chillers, and industrial occupancies and allow such alternative standards to satisfy proposed use conditions where UL 60335-2-89 is not applicable.

Response: EPA agrees with commenters that UL standard 60335-2-89 may not be appropriate to apply to all equipment in the end-uses listed

under this rule in all situations; EPA has adopted the commenters' suggestions to reevaluate the applicability of UL 60335-2-89 for this rulemaking and is finalizing that manufacturers must use ASHRAE Standard 15 for all occupancies listed in this rule. In cases where UL 60335-2-89 applies, manufacturers must also follow that standard. It is EPA's understanding that UL 60335-2-89 does not apply in machinery rooms, outdoors, or in industrial occupancies, whereas ASHRAE 15 does apply. Within this rule, industrial occupancies may apply to IPR or cold storage warehouses. Otherwise, we expect manufacturers to do the due diligence required to reasonably determine whether equipment falls under categories which are or are not covered by UL 60335-2-89.

Comment: One commenter requested that EPA not finalize a charge size limit use condition of less than 200 pounds for the listing of R-454A. The commenter stated that R-454A is a higher capacity and more efficient option than the alternatives with GWPs less than 150. The commenter stated that energy efficiency is a critical aspect of very large systems, which may be located in industrial occupancies, refrigeration rooms, or machinery rooms. The commenter added that EPA's apparent rationale for the 200 pounds charge capacity use condition was based on a higher GWP than other alternatives. The commenter felt EPA failed to adequately describe how it evaluated GWP concerns with other considerations in section 612(c) of the CAA, which requires identification of alternatives based on an overall reduction in risk to human health and the environment and an assessment of potentially available technology.

Response: See response in section II.A.6 of this preamble concerning the use condition limiting use of R-454A to equipment with charge sizes less than 200 pounds. With regard to EPA's evaluation of CAA requirements for alternatives to be considered in light of overall risk reduction and the availability of alternatives, sections II.A.6, II.F.6, and II.H.3 of this preamble explain the Agency's evaluation and selection of alternatives.

F. Cold Storage Warehouses—Listing of HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A as Acceptable, Subject to Use Conditions, for Use in New Cold Storage Warehouses

This final rule lists HFO-1234yf, HFO-1234ze(E), and the refrigerant blends R-454A, R-454C, R-455A, R-

457A, and R-516A as acceptable, subject to use conditions, for use in new cold storage warehouses.

Several use conditions required for cold storage warehouses are common to those required for the other end-uses in this rule. Because of this similarity, EPA discusses the use conditions that apply to all five end-uses in section II.H of this preamble. In summary, the common use conditions are: restricting the use of each refrigerant to new equipment that is specifically designed and clearly marked for that refrigerant; use consistent with ASHRAE 15-2022 and with UL 60335-2-89 (with certain exceptions), including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and requirements for warning labels and markings on equipment to inform consumers, technicians, and first responders of potential flammability hazards.

In addition to the common use conditions in section II.H of this preamble, the following use condition also applies to R-454A in cold storage warehouses: this substitute may only be used either in equipment with a refrigerant charge capacity less than 200 pounds or in the high-temperature side of a cascade system.

The regulatory text of the final decisions appears in tables at the end of this document and is codified in appendix Y to 40 CFR part 82, subpart G. The regulatory text contains listing decisions for the end-use discussed in this section. EPA notes that there may be other legal obligations pertaining to the manufacture, use, handling, and disposal of the refrigerants that are not included in the information listed in the tables (e.g., the CAA section 608(c)(2) venting prohibition or DOT requirements for transport of flammable gases). Flammable refrigerants being recovered or otherwise disposed of from cold storage warehouses are likely to be hazardous waste under RCRA (see 40 CFR parts 260 through 270).

1. Background on Cold Storage Warehouses

Cold storage warehouses, an end-use within the SNAP program, are refrigerated warehousing and are used to preserve meat, produce, dairy products, and other perishable goods prior to their distribution and sale.

Refrigerant choices depend on the refrigerant charge, ambient temperatures and the temperature required, system performance, energy efficiency, and health, safety and environmental considerations, among other things. The majority of cold storage warehouses in

the United States use ammonia as the refrigerant in a vapor compression cycle, although some rely on other refrigerants. In addition to regulations pursuant to the SNAP program, other Federal or local regulations may also affect refrigerant choice. For instance, regulations from OSHA may restrict or place requirements on the use of some refrigerants, such as ammonia. Building codes from local and State agencies may also incorporate limits on the charge size of particular refrigerants. EPA understands that this type of equipment may fall under the scope of UL 60335-2-89, "Household and Similar Electrical Appliances—Safety—Part 2-89: Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor" if it is not used in an industrial occupancy and that it always falls under ASHRAE 15.

EPA is listing HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, in new cold storage warehouses.

2. What are the ASHRAE classifications for refrigerant flammability?

ASHRAE 34-2022 categorizes the refrigerants for cold storage warehouses in this section as being in the A2L Safety Group. See section II.A.2 of this preamble for further discussion on ASHRAE classifications of these refrigerants.

3. What are HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A and how do they compare to other refrigerants in the same end-use?

See section II.A.3 of this preamble for further discussion on the environmental, flammability, toxicity, and exposure information for HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A.⁶⁷

Redacted submissions and supporting documentation for HFO-1234yf, HFO-1234ze(E), and the refrigerant blends are provided in the docket for this rule (EPA-HQ-OAR-2023-0043) at <https://www.regulations.gov>. EPA performed risk screening assessments to examine the health and environmental risks of

⁶⁷ EPA previously listed HFO-1234yf as acceptable, subject to use conditions, in motor vehicle AC in light-duty vehicles (74 FR 53445, October 19, 2009), in heavy-duty pickup trucks and complete heavy-duty vans (81 FR 86778, December 1, 2016) and in nonroad vehicles and service fittings for small refrigerant cans (87 FR 26276, May 4, 2022). EPA previously listed R-454A, R-454C, and R-457A as acceptable subject to use conditions as substitutes in residential and light commercial AC and heat pumps (86 FR 24444, May 6, 2021).

each of these refrigerants. These risk screens are available in the docket for this rule.^{68 69 70 71 72 73 74}

Comparison to other substitutes in this end-use: HFO–1234yf, HFO–1234ze(E), and R–454A, R–454C, R–455A, R–457A, and R–516A all have an ODP of zero, comparable to or lower than some of the acceptable substitutes in this end-use, such as ammonia with an ODP of zero and HCFO–1233zd(E) with an ODP less than 0.0004.

HFO–1234yf and HFO–1234ze(E) both have a GWP of one, comparable to that of HCFO–1233zd(E), CO₂, and ammonia with GWPs of 3.7, one, and zero respectively. R–454A, R–454C, R–455A, R–457A, and R–516A have GWPs ranging from 140 to 270, higher than some of the acceptable substitutes for new cold storage warehouses, including HCFO–1233zd(E), CO₂, and ammonia with GWPs of 3.7, one, and zero, respectively, and lower than those of other acceptable substitutes such as R–450A, R–513A, and R–407F with GWPs of about 600, 630, and 1,820, respectively.

Information regarding the toxicity of other available alternatives is provided in the listing decisions previously made (see <https://www.epa.gov/snap/substitutes-cold-storage-warehouses>). Toxicity risks of use, determined by the likelihood of exceeding the exposure limit of HFO–1234yf, HFO–1234ze(E), and the refrigerant blends in these end-uses, are evaluated in the risk screens referenced previously. The toxicity risks of using HFO–1234yf, HFO–1234ze(E), and the refrigerant blends in commercial refrigeration are comparable to or lower than toxicity risks of other available substitutes in the same end-use. Toxicity risks of the listed refrigerants can be minimized by use consistent with UL 60335–2–89 and ASHRAE 15–2022—which are required by our final use conditions—and other industry standards, recommendations in the manufacturers’ SDS, and other safety precautions common in the refrigeration and AC industry.

The flammability risks with HFO–1234yf, HFO–1234ze(E), R–454A, R–454C, R–455A, R–457A, and R–516A in this end-use, determined by the likelihood of exceeding their respective LFLs, are evaluated in the risk screens referenced previously. In conclusion, while these refrigerants may pose

greater flammability risk than other available, non-flammable substitutes in the same end-use, this risk can be minimized by use consistent with ASHRAE 15–2022 and other industry standards such as UL 60335–2–89—which is required by the use conditions in this rule—as well as recommendations in the manufacturers’ SDS and other safety precautions common in the refrigeration and AC industry. EPA is requiring use conditions to reduce the potential risk associated with the flammability of these alternatives so that they will not pose greater overall risk to human health and the environment than other acceptable substitutes in this end-use.

The listed refrigerants provide additional lower-GWP options for situations where other refrigerants with lower GWPs are not viable, such as for use of ammonia in systems with remote compressors or in locations where local regulations restrict its use, or where a lower pressure refrigerant like HCFO–1233zd(E) is not technically viable. Not all refrigerants listed as acceptable under SNAP will be suitable for the range of equipment in the cold storage warehouse end-use. To provide additional options to ensure the availability of refrigerants with lower GWPs for the full range of cold storage warehouses and, therefore, lower overall risk to human health and the environment, EPA is listing HFO–1234yf, HFO–1234ze(E), R–454C, R–455A, R–457A, and R–516A as acceptable, subject to use conditions, for use in all types of cold storage warehouses. In addition, to account for the additional challenges for finding lower-GWP refrigerants for cold storage warehouses with moderate charge sizes and for cascade systems, EPA is listing R–454A as acceptable, subject to use conditions, for use in cold storage warehouses with a charge size capacity less than 200 pounds or for use in the high-temperature side of a cascade system.

4. Why is EPA finalizing these specific use conditions?

The use conditions in the listings are explained in the preceding paragraphs and in section II.H.1 of this preamble.

This final rule applies to end-uses covered by UL 60335–2–89, including some applications in the SNAP cold storage warehouses end-use, *e.g.*, use that is not in industrial occupancies. In addition, ASHRAE 15–2022 applies to these refrigeration systems.

UL 60335–2–89 discussed in section II.H of this preamble indicates that refrigerant charges greater than a specific amount (called “m₃” in the

standard and based on the refrigerant’s LFL) should instead be determined using national standards that apply, such as ASHRAE 15–2022. Hence, EPA is requiring adherence to both standards as use conditions for cold storage warehouses, with certain exceptions.

EPA is incorporating by reference ASHRAE 15–2022, including all addenda published by the date of the proposed rule (May 24, 2023), in use conditions that apply to use of the listed A2L refrigerants in new cold storage warehouses. Where the requirements specified in this final rule and ASHRAE 15–2022 differ, the requirements of this final rule apply.

ASHRAE 15–2022 is undergoing continuous maintenance with publication of periodic addenda and is typically updated and republished every three years. Although there were additional changes to ASHRAE 15–2022 between issuance of the proposed rule and now, EPA was not able to review and seek comment on use conditions based on those more recent changes after publication of the proposal. EPA is therefore not including addenda or other changes made to ASHRAE 15–2022 after the date of the proposed rule.

EPA is finalizing as a use condition for the listing of R–454A in cold storage warehouses that this substitute may only be used either in equipment with a refrigerant charge capacity less than 200 pounds or in the high-temperature side of a cascade system. The Agency is finalizing this use condition to allow use of R–454A less broadly than for the other refrigerants being listed for use in cold storage warehouses because its GWP is higher than those of the other refrigerants (about 237, compared to one to 150). EPA’s understanding is that there are two particular situations where use of refrigerants could be more constrained, and thus, additional refrigerant options that mitigate overall risk to human health and the environment may be helpful. The first of those situations is in what the industry standard ASHRAE 15–2022 identifies as a refrigerating system having a “high probability” that leaked refrigerant from a failed connection, seal, or component could enter an occupied area. An example of such a constraint is that ASHRAE 15–2022 and UL 60335–2–89 effectively set charge limits for A2L refrigerants to less than 260 times the LFL (approximately 200 pounds for A2L refrigerants and ranging from roughly 120 to 250 pounds for the refrigerants listed in this rule) for applications inside occupied areas. In contrast, larger charge sizes could be used in “low-probability” locations where people are unlikely to come in contact with the

⁶⁸ ICF, 2023s. *Op. cit.*

⁶⁹ ICF, 2023t. *Op. cit.*

⁷⁰ ICF, 2023u. *Op. cit.*

⁷¹ ICF, 2023w. *Op. cit.*

⁷² ICF, 2023x. *Op. cit.*

⁷³ ICF, 2023y. *Op. cit.*

⁷⁴ ICF, 2023z. *Op. cit.*

refrigerant, such as systems used in industrial occupancies, outdoors or in a machinery room with access restricted to employees. Where people are unlikely to come into contact with any leaked refrigerant, there would be fewer space constraints and greater flexibility in equipment design, so refrigeration system designers can accommodate a narrower set of refrigerants. Conversely, where people are more likely to come into contact with any leaked refrigerant in an interior space, which are not industrial occupancies, refrigerant charge capacities of a system would be less than 200 pounds. In addition, in such public spaces, there would be more space constraints, less flexibility in equipment design, and potentially stricter code requirements. EPA recognizes that these may be situations where R-454A can be used where those other refrigerants cannot, especially where space is constrained. Therefore, R-454A fills a gap in the stated end-uses where lower-GWP refrigerant alternatives posing less of a risk to human health and the environment are not as available, and R-454A's GWP of approximately 240 and similar toxicity and flammability profiles would pose lower overall risk to human health and the environment. Therefore, EPA is listing R-454A as acceptable, subject to use conditions, only for cold storage warehouses with a refrigerant charge capacity less than 200 pounds.

The second situation where use of refrigerants is likely to be more constrained is for use in the high-temperature side of cascade systems used for cold storage warehouses. As discussed in section II.A.1 of this preamble, "Background on retail food refrigeration," each side of a cascade system uses a different refrigerant that is most suitable for the given temperature range. Higher temperature systems, or the "high-temperature side," have typically used HFCs as a refrigerant; however, it is technologically achievable and has become more common to use ammonia in the high-temperature side. For lower temperature systems, or the "low temperature side" of the cascade system, refrigerants with low boiling points such as R-744 can be used. Considerations for the choice of refrigerant on the high or low temperature side of cascade systems are influenced by many factors including, but not limited to, a refrigerant's toxicity and flammability, its temperature glide, and its suitability to lower temperature applications. EPA understands that use of flammable or toxic refrigerants, such as ammonia, on the high-temperature side of a cascade may be limited in

certain circumstances (*e.g.*, based on building codes and/or industry safety standards). EPA notes that there are multiple substitutes available for the low temperature side of the cascade system with GWPs lower than that of R-454A. Therefore, EPA is listing R-454A as acceptable, subject to use conditions, when it is used in the high-temperature side of cascade systems; this would expand the refrigerant options that can comply with local building codes and industry safety standards while meeting the more challenging application of the high-temperature side of a cascade system and satisfying SNAP considerations of overall risk to human health and the environment.

5. What additional information is EPA including in these listings?

EPA is providing additional information related to these listings. Since this additional information is not part of the regulatory decision under SNAP, these statements are not binding for use of the substitute under the SNAP program. EPA encourages users of substitutes to apply all statements in the "Further Information" column in their use of these refrigerants. See section II.H.2 of this preamble for further discussion on what additional information EPA is including in these listings.

6. How is EPA responding to comments on cold storage warehouses?

Comment: One commenter supported listing R-454A as acceptable in cold storage warehouses but recommended that EPA not finalize a charge size limit use condition of less than 200 pounds for three reasons. First, the commenter stated that R-454A is a higher capacity and more efficient option than alternatives with GWPs of less than 150. They stated that given the large energy requirements of cold storage warehouses, energy efficiency is a critical aspect of these systems. Second, the commenter claimed that many of these systems are in industrial occupancies, refrigeration rooms, or machinery rooms and not restricted to the charge limits, listing, and installation requirements defined by UL 60335-2-89. Third, the commenter stated that EPA failed to adequately describe how it balanced concerns regarding the GWP of R-454A versus other considerations in section 612(c) of the CAA, which requires identification of alternatives based on an overall reduction in risk to human health and the environment as well as an assessment of potentially available technology.

Response: With regard to commenters' input on a refrigerant charge limit for R-454A, see responses in sections II.A.6 and II.H.3 of this preamble concerning the Agency's rationale for the condition limiting use of R-454A to equipment with charge sizes less than 200 pounds. Concerning the energy efficiency of refrigerants for use in cold storage warehouses, EPA typically does not compare the energy efficiency of substitutes against each other unless there is a concern that equipment might not be able to meet DOE's energy conservation standards with certain substitutes. EPA is not aware of such concerns for cold storage warehouses. For instance, R-717 is an energy efficient refrigerant that is commonly used in new cold storage warehouses.

EPA agrees with the commenter that CAA section 612(c) involves considering the overall risk to human health and the environment of a substitute compared to the overall risk of other available or potentially available alternatives. In the case of R-454A, the Agency considered that there are a number of refrigerants also being listed for the same end-uses, such as HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A, and that there are other acceptable refrigerants already listed in the same end-uses, such as R-717 and R-744, that pose comparable risk to overall human health and the environment, including similar ODP, low photochemical and insignificant smog impacts in the lower atmosphere, similar or lower flammability, and exposure levels evaluated to be below relevant toxicity thresholds, when compared to R-454A. R-454A has a slightly higher GWP than the other refrigerants listed above. EPA recognizes that there may be situations where R-454A can be used where those other refrigerants cannot, especially where space is constrained. Therefore, R-454A fills a gap in the stated end-uses where lower-GWP refrigerant alternatives posing less of a risk to human health and the environment are not as available. The situations mentioned by the commenter where the charge limits of UL 60335-2-89 do not apply are situations where space is not constrained, such as outdoors or in a machinery room, and therefore, where it is less critical to use a refrigerant with higher volumetric capacity, such as R-454A. Therefore, taking into account our overall evaluation of comparative risks, it is appropriate to list R-454A for certain equipment, where it is of comparable or lower risk compared to the currently or potentially available substitutes for that particular equipment

and end-use. Also, concerning comparisons to incumbent refrigerants with higher GWPs than R-454A, see the responses in sections II.E.6 and II.H.2 of this preamble concerning R-454A in situations where other refrigerants may not be appropriate for the needs of equipment. EPA also notes that the 200-pound limit on R-454A in cold storage warehouses is consistent with a requirement in the final Technology Transitions Rule.

G. Ice Skating Rinks—Listing of HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as Acceptable, Subject to Use Conditions, for Use in New Ice Skating Rinks With a Remote Compressor

This final rule lists HFO-1234yf, HFO-1234ze(E), and the refrigerant blends R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new ice skating rinks with a remote compressor.

Several use conditions being finalized for ice skating rinks with a remote compressor in this rule are common to those finalized for other end-uses in this rule. Because of this similarity, EPA discusses the use conditions that apply to all five end-uses in section II.H of this preamble. For ice skating rinks with remote compressors, those are the only use conditions EPA is requiring. In summary, the common use conditions are: restricting the use of each refrigerant to new equipment that is specifically designed and clearly marked for that refrigerant; use consistent with ASHRAE 15-2022 and with UL 60335-2-89 (with certain exceptions), including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and requirements for warning labels and markings on equipment to inform consumers, technicians, and first responders of potential flammability hazards.

The regulatory text of the decisions appears in tables at the end of this document and is being codified in appendix Y to 40 CFR part 82, subpart G. The regulatory text contains listing decisions for the end-use discussed in this section. EPA notes that there may be other legal obligations pertaining to the manufacture, use, handling, and disposal of the refrigerants that are not included in the information listed in the tables (e.g., the CAA section 608(c)(2) venting prohibition or DOT requirements for transport of flammable gases). Flammable refrigerants being recovered or otherwise disposed of from ice skating rinks are likely to be

hazardous waste under RCRA (see 40 CFR parts 260 through 270).

1. Background on Ice Skating Rinks

Ice skating rinks, an end-use within the SNAP program, include those used by the general public for recreational purposes and also those for amateur and professional use (e.g., by professional hockey teams). These systems frequently use secondary loop refrigeration systems, where a primary loop containing a refrigerant uses a remote compressor that is in a location away from the public, such as a machinery room, and a secondary loop, containing propylene glycol, water, or another innocuous fluid, is used to directly cool the ice. Other types of refrigeration systems for ice skating rinks use a direct heat exchange system, where the refrigerant moves directly under the rink. The listings apply only to ice skating rinks that have a remote compressor.

For ice skating rinks, refrigerant choice depends on the refrigerant charge; ambient temperatures and the temperature required; system performance; energy efficiency; and health, safety, and environmental considerations, among other things. In addition to regulations pursuant to the SNAP program, other Federal or local regulations may also affect refrigerant choice. For instance, regulations from OSHA may restrict or place requirements on the use of some refrigerants, such as ammonia. Building codes from local and State agencies may also incorporate limits on the amount of particular refrigerants used. Acceptable substitutes in use today for new ice skating rinks include ammonia, CO₂, HCFO-1233zd(E) as well as HFCs and HFC/HFO blends. These can be used alone or in combination with other refrigerants in other parts of the equipment, depending on the equipment and its design (e.g., a secondary loop contains one refrigerant while the primary loop contains a different refrigerant). It is EPA's understanding that this type of equipment may fall under the scope of UL 60335-2-89, "Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor" if it is not used in an industrial occupancy and that it always falls under ASHRAE 15.

2. What are the ASHRAE classifications for refrigerant flammability?

ASHRAE 34-2022 categorizes the refrigerants listed for ice skating rinks in this section as being in the A2L Safety Group. See section II.A.2 of this

preamble for further discussion on ASHRAE classifications of these refrigerants.

3. What are HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A and how do they compare to other refrigerants in the same end-use?

See section II.A.3 of this preamble for further discussion on the environmental, flammability, toxicity, and exposure information for these refrigerants.

Redacted submissions and supporting documentation for HFO-1234yf, HFO-1234ze(E) and the blends R-454C, R-455A, R-457A and R-516A are provided in the docket for this rule (EPA-HQ-OAR-2023-0043) at <https://www.regulations.gov>. EPA performed a risk screening assessment to examine the health and environmental risks of each of these refrigerants. These risk screens are available in the docket for this rule.^{75 76 77 78 79 80}

Comparison to other substitutes in this end-use: HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A all have an ODP of zero, comparable to or lower than some of the acceptable substitutes in this end-use, such as ammonia with an ODP of zero and HCFO-1233zd(E) with an ODP of less than 0.0004.

HFO-1234yf and HFO-1234ze(E) both have a GWP of one, comparable to or lower than that of other acceptable substitutes for new ice skating rinks, such as ammonia, CO₂, and HCFO-1233zd(E) with GWPs of zero, one, and 3.7, respectively.

R-454C, R-455A, R-457A, and R-516A have GWPs ranging from about 140 to 150 which are higher than that of other acceptable substitutes for ice skating rinks, including ammonia, CO₂, and HCFO-1233zd(E) with GWPs of zero, one, and 3.7, respectively. The GWPs of HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A are lower than some of the substitutes acceptable under SNAP for new ice skating rinks, such as R-450A, and some substitutes currently in use but do not meet the GWP limits for use in new ice skating rinks under the Technology Transitions Rule such as R-449A and R-507A with GWPs of approximately 600, 1,400, and 3,990, respectively.

Information regarding the toxicity of other available alternatives is provided

⁷⁵ ICF, 2023s. *Op. cit.*

⁷⁶ ICF, 2023t. *Op. cit.*

⁷⁷ ICF, 2023w. *Op. cit.*

⁷⁸ ICF, 2023x. *Op. cit.*

⁷⁹ ICF, 2023y. *Op. cit.*

⁸⁰ ICF, 2023z. *Op. cit.*

in the listing decisions previously made (see <https://www.epa.gov/snap/substitutes-ice-skating-rinks>). Toxicity risks of use, determined by the likelihood of exceeding the exposure limit of HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A in these end-uses, are evaluated in the risk screens referenced previously. The toxicity risks of using HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A in ice skating rinks with remote compressors are comparable to or lower than toxicity risks of other available substitutes in the same end-use. Toxicity risks of the listed refrigerants can be minimized by use consistent with UL 60335-2-89 and ASHRAE 15-2022—which are required by our final use conditions—and other industry standards, recommendations in the manufacturers' SDS, and other safety precautions common in the refrigeration and AC industry.

The potential flammability risks of HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A in this end-use, determined by the likelihood of exceeding their respective LFLs, are evaluated in the risk screens referenced previously. These risk screens determined that because ice skating rink systems would be installed in locations with adequate space and/or ventilation in accordance with EPA recommendations and requirements, industry standards, and the installation and maintenance manuals for equipment using these refrigerants, significant flammability risk to end-users, personnel, or the general population is unlikely. In conclusion, while these refrigerants may pose greater flammability risk than other available substitutes in the same end-use, this risk can be minimized by use consistent with ASHRAE 15-2022 and other industry standards such as UL 60335-2-89—which is required by our use conditions—as well as recommendations in the manufacturers' SDS and other safety precautions common in the refrigeration and AC industry. EPA is requiring use conditions to reduce the risk associated with the flammability of these alternatives so that they will not pose greater overall risk to human health and the environment than other acceptable substitutes in this end-use. In addition, EPA is limiting these listings to equipment with a remote compressor. Such equipment reduces the chances of fire and of exposure to the general public compared to refrigerants that are piped directly under an ice skating rink.

In addition, the listed substitutes have lower GWPs than most other available alternatives for the same end-use. The

listed refrigerants may provide additional lower-GWP options for situations where other refrigerants with lower GWPs are not viable, such as in locations where local regulations restrict use of ammonia. Not all refrigerants listed as acceptable under SNAP will be suitable for the range of equipment in the ice skating rinks end-use. To provide additional options to ensure the availability of refrigerants with lower GWPs for ice skating rinks and, therefore, lower overall risk to human health and the environment, EPA is listing HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new ice skating rinks.

4. Why is EPA finalizing these specific use conditions?

The final use conditions identified in the listings are explained in section II.H.1 of this preamble.

This final rule applies to end-uses covered by UL 60335-2-89, including some applications in the SNAP ice skating rink end-use, e.g., use that is not in industrial occupancies. In addition, ASHRAE 15-2022 applies to these refrigeration systems.

EPA is incorporating by reference UL 60335-2-89. This standard, as discussed in section II.H of this preamble, states that refrigerant charges greater than a specific amount (called "m₃" in the standard and based on the refrigerant's LFL) should instead be determined using national standards that apply, such as ASHRAE 15-2022. Hence, EPA is requiring adherence to both standards as use conditions for ice skating rinks, with certain exceptions.

EPA is incorporating by reference UL 60335-2-89 and ASHRAE 15-2022 in use conditions that apply to use of the listed A2L refrigerants in new ice skating rinks. Where the requirements specified in this final rule and ASHRAE 15-2022 differ, the requirements of this final rule apply.

ASHRAE 15-2022 is undergoing continuous maintenance with publication of periodic addenda and is typically updated and republished every three years. Although there were additional changes to ASHRAE 15-2022 between issuance of the proposed rule and now, EPA was not able to review and seek comment on use conditions based on those more recent changes after publication of the proposal. EPA is therefore not including addenda or other changes made to ASHRAE 15-2022 after the date of the proposed rule.

EPA is finalizing a use condition that the six A2L refrigerants included in this listing may only be used in new equipment that includes a remote

compressor. This is intended to ensure that these flammable refrigerants are only used away from the presence of ice skaters and other members of the general public. This would reduce the likelihood of exposure or leaks of the refrigerant near the general public and instead allow facility employees and trained technicians to control access to the refrigerant.

5. What additional information is EPA including in these listings?

EPA is providing additional information related to these listings. Since this additional information is not part of the regulatory decision under SNAP, these statements are not binding for use of the substitute under the SNAP program. 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 refrigerants. See section II.H.2 of this preamble for further discussion on what additional information EPA is including in these listings.

6. How is EPA responding to comments on ice skating rinks?

Comment: One commenter requested that EPA include R-454A as an acceptable refrigerant for ice skating rinks without a 200-pound charge size limit, in alignment with the proposal's listing for IPR and cold storage warehouses. The commenter also claimed that EPA did not provide sufficient explanation why R-454A was unacceptable in this end-use or why EPA did not to proceed with a filed SNAP petition to find R-454A acceptable. The commenter stated that EPA must consider all effects contemplated by CAA section 612(c) and may not only focus on relative GWP in making decisions. The commenter noted that additional rationale for this determination appears in the docket.

Response: With respect to the comment that EPA must take into account all the effects contemplated by CAA section 612(c), the Agency responds that it has appropriately considered these listing decisions, as required by CAA section 612(c) and EPA's implementing regulations, including in its consideration of overall risk to human health and the environment compared to overall risk posed by other available or potentially available substitutes in the same uses. EPA evaluates not only relative GWP but all of the criteria for review that are required under the SNAP regulations at 40 CFR 82.180(a)(7) for our comparative risk analysis, including atmospheric

effects; general population risks from ambient exposure to increased ground-level ozone (e.g., volatile organic compound assessment) or due to direct toxicity of compounds; ecosystem effects (e.g., analysis of impacts of breakdown products on aquatic life); flammability risks, occupational risks (e.g., toxicity of direct exposure to workers or asphyxiation risks), and consumer risks (e.g., toxicity of exposure to consumers at end-use). These considerations are reflected in the risk screens found in the docket for this rule and in the discussion supporting the listing decisions for the listings finalized in this rule. With respect to the commenter's reference to a filed SNAP petition to find R-454A acceptable, the Agency notes that we received a SNAP submission from a manufacturer but is not aware of a formal petition regarding this refrigerant. EPA did not propose to list R-454A for use in ice skating rinks, either as acceptable or unacceptable, and is not making a final decision in the rule regarding whether to list R-454A in this end-use. EPA may consider listing R-454A in this or other end-uses in future SNAP listing rules.

H. Use Conditions and Further Information for Retail Food Refrigeration, Commercial Ice Machines, Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks With a Remote Compressor

1. What use conditions is EPA finalizing and why?

As previously described, EPA is listing:

- HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new equipment in stand-alone units, retail food remote condensing units, supermarket systems, and refrigerated food processing and dispensing equipment;
 - R-454A as acceptable, subject to use conditions, for use in new equipment in retail food remote condensing units and supermarket systems;
 - R-290 as acceptable, subject to use conditions, for use in new refrigerated food processing and dispensing equipment;
 - HFC-32, HFO-1234yf, R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new commercial ice machines;
 - HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for used in new IPR

equipment and HFC-32 and R-454B, as acceptable, subject to use conditions, for use in new chillers for IPR and in IPR equipment with the refrigerant temperature entering the evaporator or the temperature of the exiting fluid less than or equal to -30°C ;

- HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new cold storage warehouses; and
- HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, for use in new ice skating rinks with remote compressors.

In addition, EPA is revising the use conditions that apply to the existing listings of:

- R-290 as acceptable, subject to use conditions, for use in new retail food refrigeration stand-alone units; and
- R-290 as acceptable, subject to use conditions, for use in new self-contained commercial ice machines.

The use conditions (either as new listings or revisions to an existing listing) common to all listing decisions in this rule are: restricting the use of each refrigerant to new equipment that is specifically designed and clearly marked for the refrigerant; use consistent with ASHRAE 15-2022 and with UL 60335-2-89 (with certain exceptions), including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and requirements for warning labels and markings on equipment to inform consumers, technicians, and first responders of potential flammability hazards. Additional specific use conditions are intended to allow for the use of these flammable refrigerants in a manner that will ensure they do not pose a greater overall risk to human health and the environment than other substitutes in these end-uses.

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

EPA is requiring that these refrigerants be used only in new equipment which has been designed to address concerns unique to flammable refrigerants. In other words, none of these refrigerants are being listed as acceptable to be used as a conversion or "retrofit" refrigerant for existing equipment. EPA is unaware of information on how to address hazards if these flammable refrigerants were to be used in equipment that was designed for non-flammable refrigerants. Given the flammable nature of these refrigerants, the fact that EPA is unaware of information to assess the

risk if such retrofits were allowed, and because the refrigerants were not submitted to the SNAP program for retrofits, EPA has not reviewed them for retrofit applications and is requiring that they be used only in new equipment which has been properly designed for their use. This use condition does not affect the ability to service a system using one of these refrigerants once installed, including the adding of refrigerant or replacing components.

Standards

To ensure safe use of the listed refrigerants, EPA is incorporating by reference certain industry consensus safety standards in a use condition. Specifically, the Agency is requiring that the flammable refrigerants may be used only in equipment that meets requirements in ASHRAE 15-2022 and in UL 60335-2-89, 2nd edition (with certain exceptions). Exceptions include equipment that is outside the scope of UL 60335-2-89; equipment installed in situations where UL 60335-2-89 refers to "national standards" (e.g., where equipment is installed in a machinery room or outdoors); and equipment installed in "industrial occupancies," as defined in ASHRAE 15-2022. In the latter situation, these refrigerants must be used in equipment installed consistent with the requirements of ASHRAE 15-2022 without meeting the requirements of UL 60335-2-89.

Section 1 of UL 60335-2-89 defines the scope of that standard. It lists both specific types of equipment that fall under the standard and equipment that falls outside the scope of the standard. Examples of equipment that are included within the scope of UL 60335-2-89 include refrigerated display and storage cabinets, refrigerated trolley cabinets, service counters, factory-assembled walk-in coolers and freezers, refrigerated food processing and dispensing equipment, commercial refrigeration products with rated voltage up to 15,000 V, and commercial ice machines. Examples of equipment that fall outside the scope of UL 60335-2-89 include appliances using flammable refrigerant in transcritical refrigeration systems, commercial refrigeration products with rated voltage of 15,000 V or greater, motor compressors, household refrigerating appliances that fall under the scope of UL 60335-2-24, vending machines, and professional or commercial ice-cream machines. This final rule does not apply to these types of commercial refrigeration equipment that fall outside the scope of UL 60335-2-89. Commercial refrigeration equipment that falls outside the scope of

UL 60335-2-89 in situations where UL 60335-2-89 refers to “national standards” is still required to meet ASHRAE 15-2022 under this final rule. ASHRAE 15-2022 enforces, rather than replaces, UL 60335-2-89, by providing instructions for installation of equipment and requirements for situations beyond the scope of UL 60335-2-89, *e.g.*, for use in refrigeration systems with large charge sizes in a machinery room or outdoors.

Under the existing SNAP listings, new stand-alone units using R-290 have been subject to a use condition to meet the requirements of Appendix SB of the 10th edition of UL 471. In this final action, stand-alone units using R-290 manufactured before the effective date may continue to be used under SNAP and will remain in compliance with the existing SNAP use conditions as long as they meet the applicable use conditions when they were manufactured. New stand-alone units using R-290 manufactured from the effective date of this final rule through September 29, 2024, must meet the requirements of either Appendix SB of the 10th edition of UL 471 or UL 60335-2-89, dependent upon which standard they were certified, to comply with the use conditions established in this final action. Similarly, new stand-alone units using R-290 that are manufactured on or after September 30, 2024, must meet the requirements of UL 60335-2-89, rather than the earlier UL standards, unless the new stand-alone units remain essentially unchanged from an earlier model or design that was already UL-listed to the earlier UL 471 standard.

Similarly, under the use conditions in the existing SNAP listings, new self-contained commercial ice machines using R-290 have been subject to the requirements of Appendix SA of the 8th edition of UL 563. In this final action, commercial ice machines using R-290 manufactured before the effective date of this final rule may continue to be used under SNAP and will remain in compliance with the SNAP use conditions as long as they met the applicable use conditions when they were manufactured. New self-contained commercial ice machines using R-290 that are manufactured from the effective date of this final rule through September 29, 2024, must meet the requirements of either Appendix SA of the 8th edition of UL 563 or UL 60335-2-89, contingent upon which standard the equipment was designed, to comply with the use conditions established in this final action. Similarly, new self-contained commercial ice machines using R-290 that are manufactured on or after September 30, 2024, must meet the

requirements of UL 60335-2-89, rather than the earlier UL standards, unless the new stand-alone units remain essentially unchanged from an earlier model or design that was already UL-listed to the earlier UL 563 standard.

UL 60335-2-89 includes requirements for construction and system design, for markings, and for performance tests concerning refrigerant leakage, ignition of switching components, surface temperature of parts, and component strength after being scratched. UL 60335-2-89 was developed through 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. Those participating in the UL 60335-2-89 consensus standards process have tested equipment for flammability risk and evaluated the relevant scientific studies. While similar standards exist from other bodies such as the International Electrotechnical Commission (IEC), we are relying on specific UL standards that are most applicable and recognized by the U.S. market. This approach is the same as that in our previous listing determinations for flammable refrigerants (*e.g.*, 76 FR 78832, December 20, 2011; 80 FR 19454, April 10, 2015; 86 FR 24444, May 6, 2021; and 87 FR 45508, July 28, 2022).

A summary of the requirements of the 2nd edition of UL 60335-2-89 as they affect the listed refrigerants and end-uses is offered here for information only and does not provide a complete review of the requirements in this standard. Please consult the standard itself for additional information.

The requirements in UL 60335-2-89 reduce the risk to workers and consumers posed by flammable refrigerants. UL 60335-2-89 limits the amount of refrigerant allowed in each type of appliance based on several factors explained in that standard. The standard specifies requirements for installation space of an appliance (*e.g.*, room floor area) and/or ventilation or other requirements that are determined according to the refrigerant charge used in the appliance, the installation location, and the type of ventilation of the location or of the appliance. UL 60335-2-89 contains provisions for safety mitigation when using larger charges of A2L refrigerants or when using A2L refrigerants in equipment with a remote compressor. These mitigation requirements were developed to ensure the safe use of flammable refrigerants over a range of appliances. In general, as larger charge sizes are used, more stringent mitigation

measures are required. In certain applications, refrigerant detection systems (as described in Annex 101.DVP, *Refrigerant detection systems for A2L refrigerants*); means of mitigation (as described in Annex 101.DVU, including air circulation, ventilation, shut off valves, etc.); and refrigerant sensors (as described in 101.DVP, *Refrigerant sensor for REFRIGERANT DETECTION SYSTEMS*) are required. Where air circulation (*e.g.*, fans) is required in accordance with Annex 101.DVU, it must be initiated by a separate refrigerant detection system either as part of the appliance or installed separately. In a room with no mechanical ventilation, Annex 101.DVU1.7 provides requirements for openings to rooms based on several factors, including the charge size and the room area. The minimum opening is intended to be sufficient so that natural ventilation would reduce the risk of using a flammable refrigerant. The standard also includes specific requirements covering construction, instruction manuals, allowable charge sizes, mechanical ventilation, safety alarms, and shut off valves for A2L refrigerants.

In addition to Annex 101.DVU, UL 60335-2-89 has a requirement for the maximum charge for an appliance using a flammable refrigerant, including A2L, A2, and A3 refrigerants. Additional requirements exist for charge sizes exceeding three times the LFL.

Systems with refrigerant charges exceeding certain amounts are outside the scope of UL 60335-2-89; however, national standards apply instead, namely, ASHRAE 15-2022. Specifically, for a field-charged system, if the refrigerant circuit with the greatest mass of an A2L refrigerant contains more than 260 times the LFL (in kg/m³), such a refrigerant circuit can only be used outdoors or in a machinery room where the requirements of ASHRAE 15-2022 apply. For example, HFC-32 has an LFL of approximately 0.307 kg/m³ (0.0192 lb/ft³); therefore, a single refrigerant circuit exceeding 79.82 kg (176.0 lb) would fall outside the scope of UL 60335-2-89. In such situations, the refrigerant circuit would need to be used in outdoor equipment or in a machinery room and the installation would need to meet the requirements of ASHRAE 15-2022. For self-contained equipment using an A3 refrigerant, the maximum charge size is 13 times the LFL (approximately 500 g of R-290) for equipment that is open and contains no doors or drawers and eight times the LFL (approximately 300 g of R-290) for equipment with doors or drawers. EPA expects that many types of retail

refrigeration equipment could exceed these charge thresholds and therefore is finalizing that an additional safety standard, ASHRAE 15–2022, apply to commercial refrigeration equipment using flammable refrigerants, as discussed in section II.A of this preamble. ASHRAE 15–2022 supplements, rather than replaces, UL 60335–2–89, by providing instructions for installation of equipment and requirements for situations beyond the scope of UL 60335–2–89. In addition, ASHRAE 15–2022 refers to some spaces as “industrial occupancies,” in which refrigerating systems must follow ASHRAE 15–2022 and businesses may have custom-designed refrigeration equipment that has not typically been designed to meet UL standards for products. ASHRAE 15–2022 defines “industrial occupancies” as “a premise or that portion of a premise that is not open to the public, where access by authorized persons is controlled, and that is used to manufacture, process, or store goods such as chemicals, food, ice, meat, or petroleum.” Many, but not all, spaces where IPR equipment, cold storage warehouses, and ice skating rink systems are used qualify as industrial occupancies.

Under the existing SNAP listings, new stand-alone units using R–290 have been subject to a use condition to meet the requirements of Appendix SB of the 10th edition of UL 471. In this final action, stand-alone units using R–290 manufactured before the effective date may continue to be used under SNAP and will remain in compliance with the existing SNAP use conditions as long as they meet the applicable use conditions when they were manufactured. New stand-alone units using R–290 manufactured from the effective date of this final rule through September 29, 2024, must meet the requirements of either Appendix SB of the 10th edition of UL 471 or UL 60335–2–89 to comply with the use conditions established in this final action. Similarly, new stand-alone units using R–290 that are manufactured on or after September 30, 2024, must meet the requirements of UL 60335–2–89, rather than the earlier UL standards, unless the new stand-alone units remain essentially unchanged from an earlier model or design that was already UL-listed to the earlier UL 471 standard.

Similarly, under the existing SNAP listings, new self-contained commercial ice machines using R–290 have been subject to the requirements of Appendix SA of the 8th edition of UL 563. In this final action, commercial ice machines using R–290 manufactured before the effective date of this final rule may

continue to be used under SNAP and will remain in compliance with the SNAP use conditions as long as they met the applicable use conditions when they were manufactured. New self-contained commercial ice machines using R–290 that are manufactured from the effective date of this final rule through September 29, 2024, must meet the requirements of either Appendix SA of the 8th edition of UL 563 or UL 60335–2–89 to comply with the use conditions established in this final action. Similarly, new self-contained commercial ice machines using R–290 that are manufactured on or after September 30, 2024, must meet the requirements of UL 60335–2–89, rather than the earlier UL standards, unless the new stand-alone units remain essentially unchanged from an earlier model or design that was already UL-listed to the earlier UL 471 standard.

Warning Labels—Equipment With A2L Refrigerants

EPA is requiring labeling of refrigerating systems used in retail food refrigeration equipment, commercial ice machines, IPR equipment, cold storage warehouses, and ice skating rinks (“equipment”) containing the listed lower flammability (A2L) refrigerants. The text of these labels can also be found in Annex 101.DVV of UL 60335–2–89. References to “the UL standard” below are to UL 60335–2–89, 2nd edition. The following labels, or the equivalent, must be provided in letters no less than 6.4 mm (¼ inch) high and must be permanent:

1. On the outside of the unit: “WARNING—Risk Of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”
2. On the outside of the equipment: “WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”
3. On the inside of the equipment near the compressor: “WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner’s Guide Before Attempting to Service This Product. All Safety Precautions Must Be Followed.”

4. For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: “WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations.”

- a. If the equipment is delivered packaged, this label shall be applied on the packaging.

b. If the equipment is not delivered packaged, this label shall be applied on the outside of the appliance.

EPA expects that all stand-alone units, self-contained commercial ice machines, and self-contained refrigerated food processing and dispensing equipment would be packaged, and hence this label would be placed as stipulated in item a above. EPA expects that other types of commercial refrigeration equipment could be provided packaged or not, and this label would be placed as stipulated in item a or b, respectively.

5. On indoor unit near the nameplate:

- a. At the top of the marking: “Minimum installation height, X m (W ft)”. This marking is only required if the similar marking is required by UL 60335–2–89. The terms “X” and “W” shall be replaced by the numeric height as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.

b. Immediately below 5.a or at the top of the marking if 5.a is not required: “Minimum room area (operating or storage), Y m² (Z ft²)”. The terms “Y” and “Z” shall be replaced by the numeric floor area as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the area in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.

6. For non-fixed equipment, including on the outside of the appliance:

“WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition.”

7. For fixed equipment that is ducted, near the nameplate: “WARNING—Risk of Fire—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.”

Labeling requirements 1, 2, and 3 apply to all refrigeration equipment; labeling requirement 4 applies only to self-contained equipment that is pre-charged by the manufacturer (e.g., stand-alone units or self-contained commercial ice machines); labeling requirement 5 applies to equipment with a remote compressor, also called a “split” or “remote” system (e.g., remote condensing unit, supermarket system, or refrigerating system for an ice skating rink with a remote compressor). A piece of refrigeration equipment that may be moved from one location to another and

is typically self-contained is referred to as “non-fixed” in labeling requirement 6 (e.g., stand-alone units).

EPA notes that Annex 101.DVV of UL 60335–2–89 specifies that the labels must include text with a font size that is no less than 3.2 mm (1/8 inch) high for A2L refrigerants, while the Agency is requiring a larger, more visible font size of 6.4 mm (1/4 inch). The Agency is concerned that it is difficult to see warning labels with the minimum lettering height requirement of 1/8 inch in UL 60335–2–89. Therefore, as in the requirements in our previous rules for use of A2L refrigerants in residential and light commercial air conditioning and heat pumps (80 FR 19453, April 10, 2015; 86 FR 24444, May 6, 2021), as well as our previous rules for HC refrigerants (76 FR 78832, December 20, 2011; 80 FR 19453, April 10, 2015; 81 FR 86778, December 1, 2016), EPA is requiring that the minimum height for lettering be 1/4 inch as opposed to 1/8 inch. This will make it easier for technicians, consumers, retail storeowners, and first responders to view the warning labels.

Warning Labels—Equipment With A3 Refrigerants, Including R–290

As a final use condition for refrigerated food processing and dispensing equipment and a revision to existing use conditions for stand-alone units and commercial ice machines, EPA is requiring labeling of such equipment containing R–290. The text of these labels can also be found in Annex 101.DVV of UL 60335–2–89. References to “the UL standard” below are to UL 60335–2–89. The following markings, or the equivalent, must be provided in letters no less than 6.4 mm (1/4 inch) high and must be permanent:

1. On the outside of the unit: “DANGER”—Risk Of Fire Or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”

2. On the outside of the equipment: “WARNING—Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”

3. On the inside of the equipment near the compressor: “DANGER—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.”

4. For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: “DANGER—Risk of Fire or Explosion due to Flammable Refrigerant Used.

Follow Handling Instructions Carefully in Compliance with National Regulations.”

a. If the equipment is delivered packaged, this label shall be applied on the packaging.

b. If the equipment is not delivered packaged, this label shall be applied on the outside of the appliance.

EPA expects that all stand-alone units and self-contained commercial ice machines and self-contained refrigerated food processing and dispensing equipment would be packaged, and hence this label would be placed as stipulated in item a above. EPA expects that other types of commercial refrigeration equipment could be provided packaged or not, and this label would be placed as stipulated in item a or b, respectively.

5. On indoor unit near the nameplate:

a. At the top of the marking: “Minimum installation height, X m (W ft)”. This marking is only required if the similar marking is required by UL 60335–2–89. The terms “X” and “W” shall be replaced by the numeric height as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.

b. Immediately below 5.a or at the top of the marking if 5.a is not required: “Minimum room area (operating or storage), Y m² (Z ft²)”. The terms “Y” and “Z” shall be replaced by the numeric area as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the area in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.

6. For non-fixed equipment, including on the outside of the appliance: “WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition.”

7. For fixed equipment that is ducted, near the nameplate: “WARNING—Risk of Fire or Explosion—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.”

The text of the warning labels is exactly the same as that required in UL 60335–2–89, with the exception of the label identified in 5, which is similar to but slightly different from that in UL 60335–2–89. The text for A3 refrigerants differs slightly from that for A2L refrigerants, sometimes using the word “DANGER” instead of “WARNING,”

and sometimes referring to “Risk of Fire or Explosion” instead of “Risk of Fire.” For R–290 and other A3 refrigerants, UL 60335–2–89 requires the labels to be no less than 6.4 mm (1/4 inch) high in the standard, the same as EPA is requiring in this action.

Markings

EPA is requiring as a use condition that the refrigerants must be used in refrigerating equipment that has red, Pantone® Matching System (PMS) #185 or RAL 3020 marked pipes, hoses, and other devices through which the refrigerant is serviced, typically known as the service port, to indicate the use of a flammable refrigerant. This color must be present at all service ports and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes). The color mark must extend at least 2.5 centimeters (1 inch) from the compressor and must be replaced if removed. EPA has applied this same use condition in past actions for flammable refrigerants (76 FR 78832, December 20, 2011; 80 FR 19454, April 10, 2015; 81 FR 86778, December 1, 2016; 86 FR 24444, May 6, 2021; and 87 FR 45508, July 28, 2022). Our understanding of UL 60335–2–89 is that red markings similar to those finalized are required by UL 60335–2–89 for all flammable refrigerants. EPA is requiring that such markings apply through the SNAP use conditions as well to establish a common, familiar, and standard means of identifying the use of a flammable refrigerant.

These red markings allow technicians to immediately identify the use of a flammable refrigerant, thereby reducing the risk of using sparking equipment or otherwise having an ignition source nearby. It also provides adequate notification of the presence of flammable refrigerants for personnel disposing of appliances containing flammable refrigerants. The AC and refrigeration industry currently uses red-colored hoses and piping as means for identifying the use of a flammable refrigerant based on previous SNAP listings and some industry standards. 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 and electric vehicles. Currently in SNAP listings, color-coded hoses or pipes must be used for ethane, HFC–32, R–452B, R–454A, R–454B, R–454C, R–457A, R–600a, R–290, and R–441A in equipment wherever these are listed acceptable, subject to use conditions.

All such tubing must be colored red PMS #185 or RAL 3020. As explained in SNAP Rule 19, one mechanism to distinguish hoses and pipes is to add a colored plastic sleeve or cap to the service tube (80 FR 19465, April 10, 2015). Other methods, such as a red-colored tape, may be used. The colored plastic sleeve, cap, or tape must have to be forcibly removed to access the service tube and must be replaced if removed. This sleeve, cap, or tape would be of the same red color (PMS #185 or RAL 3020) 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 dyeing the hose or pipe.

EPA is requiring the use of color-coded hoses or piping in addition to requiring the use of warning labels discussed previously. Having two warning methods is reasonable and consistent with other general industry practices. This approach is the same as that adopted in our previous rules on flammable refrigerants (e.g., 76 FR 78832, December 20, 2011; 80 FR 19454, April 10, 2015; 86 FR 24444, May 6, 2021; and 87 FR 45508, July 28, 2022).

EPA proposed a diamond symbol for “Caution, risk of fire” that would be used in addition to the red triangle in Clause 7.6DV D1 of UL 60335–2–89. After considering public comments, EPA is not finalizing a requirement for the diamond symbol in this rule (see section II.H.3 of this preamble). However, manufacturers will be required to place either the red triangle symbol described in UL 60335–2–89, 2nd edition, or the red diamond symbol that was proposed (for more information, see section II.H.3 of this preamble), or both.

For those that choose to comply with fire hazard marking in this rule by using the red-bordered diamond, refer to the symbol which has been finalized for hazard category 1 flammable gases in the docket for this rulemaking under the title, “Final Flammability Hazard Symbol.” This symbol is included as the warning symbol for hazard category 1 flammable gases in the 9th edition of the GHS for communicating risks of chemicals. This symbol for hazard category 1 flammable gases is included in the 4th edition of UL 60335–2–40 (December 2022), UL’s most recent safety standard for air conditioning equipment, heat pumps, and humidifiers, and is being considered for adoption in the future 3rd edition of UL 60335–2–89. It is found in section 1.2 of Annex 1 of the 9th edition of the GHS.

For those that choose to comply with fire hazard markings in this rule by using the red-bordered diamond, this

marking shall be placed near the service port or other location where charging occurs; on the label on the outside of the unit; and either on the appliance packaging, if the refrigeration equipment is charged at the factory or on the nameplate or control panel for the refrigeration equipment that is charged in place. These locations correspond with the locations for red markings and for labels 1 and 4 mentioned above on the outside of the refrigerating unit, and either on the packaging or on the nameplate or control panel. If used, the diamond symbol for hazard category 1 flammable gases needs to be at least 15 mm (9/16 inches high). The Agency notes that it may propose to require the adoption of this symbol in a future rulemaking when a new edition of UL 2–89 is released.

2. What additional information is EPA including in these listings?

For retail food refrigeration, commercial ice machines, IPR, cold storage warehouses, and ice skating rinks with remote compressors, EPA is including recommendations, found in the “Further Information” column of the regulatory text, to protect personnel from the risks of using flammable refrigerants. Similar to our previous listings of flammable refrigerants, EPA is including information on the OSHA requirements at 29 CFR part 1910, proper ventilation, personal protective equipment, fire extinguishers, use of spark-proof tools and equipment designed for flammable refrigerants, and training. Since this additional information is not part of the regulatory decision under SNAP, these statements are not binding for use of the substitute under the SNAP program. 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 refrigerants.

3. How is EPA responding to comments on use conditions?

Comment: Four commenters suggested clarifications surrounding manufacturers’ use of R–290 in self-contained products (150 grams or less). The commenters stated that the proposal references a sunset of UL 471. They noted that UL will allow manufacturers to continue under UL 471 and UL 563 requirements until a significant product change is made or the manufacturer withdraws their file. The commenters stated that only at that time will R–290 equipment become

subject to 60335–2–89. They asked for EPA to clarify this in the final rule.

Response: EPA thanks the commenters for bringing to our attention that UL allows manufacturers to continue manufacturing equipment under UL 471 or UL 563 requirements until a significant product change is made or the manufacturer withdraws their UL listing file. As discussed above, certain listings in this final rule include an option for new equipment using R–290 to be manufactured according to UL 471 and UL 563 if certain criteria are met. Further, we note that UL 471, UL 563, and UL 60335–2–89 all address the potential hazards of using flammable refrigerants. Thus, these listings include options for new equipment to meet any of these standards, provided that, for UL 471 or 563, the equipment or model was designed and UL-listed according to one of those standards before the sunset date of UL 471 or UL 563.

Comment: Six commenters requested that EPA align its proposal with regard to existing safety standards for A2Ls and other flammable refrigerants. These commenters noted that for the end-uses in the proposal ASHRAE 15 is the appropriate standard, with UL 60335–2–89 only applicable in certain end-uses. They noted that equipment is built to ASHRAE 15, B31.5 or B31.3, National Electrical Code (NEC) and possibly IIAR standards; therefore, compliance with UL 60335–2–89 for these end-uses could create conflict within the industry.

Several commenters stated there was misalignment in standards and the proposal for specific end-uses. Three commenters noted that for systems located in industrial occupancies, ASHRAE 15 states these locations do not have to be listed to UL 60335–2–89 and charge limits do not apply. These commenters stated that some IPR, IPR chiller, cold storage warehouse, and ice skating rink applications located in industrial occupancies would fall outside the scope of UL 60335–2–89. For IPR chillers, a different commenter stated that the application of UL 60335–2–89 is sufficient to mitigate the risks posed by the use of A2L refrigerants because of the requirements for preventing ignition of A2L refrigerants from electrical parts/devices and hot surfaces, the detection system for A2L refrigerants, the manual of operation, service, and installation, the warning labels and markings, and the competence of personnel. Four commenters noted that professional ice cream appliances are specifically excluded from the scope of UL 60335–2–89, and that this equipment follows UL 621, which has not been updated to allow for use of flammable refrigerants.

One commenter added that for SNAP 26 to apply to ice cream machines the use conditions must include UL 621 and 60335–2–89.

Response: EPA agrees with the commenters that ASHRAE 15 is an applicable standard to all the end-uses in this rule, with UL 60335–2–89 applicable to certain applications in the end-uses of this rule. UL 60335–2–89 should be followed where applicable in addition to the standard requirements under ASHRAE 15. Based on EPA’s review of UL 60335–2–89 and conversations with UL, it is EPA’s understanding that some IPR, IPR chiller, cold storage warehouse, and ice skating rink applications located in industrial occupancies have not followed UL 60335–2–89 and instead have followed ASHRAE 15. After considering all the public comments on the proposal, we are finalizing use conditions requiring ASHRAE 2022–15 for all substitutes listed in this rule and UL 60335–2–89 where it applies, as use conditions for refrigerants in the end-uses covered by this rulemaking, with modifications in response to the comments received. In particular, the final regulatory text requires that (1) ASHRAE 15–2022 applies in all cases and (2) UL 60335–2–89 applies, with exceptions for equipment that is outside the scope of UL 60335–2–89, equipment installed in situations where that standard refers to “national standards,” (*i.e.*, ASHRAE 15), and for the flammability marking identified in Clause 7.6DV D1 of UL 60335–2–89 (where the equipment must display either or both of the red triangle or red bordered diamond symbol). To allow for better alignment with the two industry standards, EPA has revised the regulatory text concerning UL 60335–2–89 to state, “These refrigerants may only be used in refrigeration equipment that meets all requirements in UL 60335–2–89, except as provided otherwise in UL 60335–2–89, in ASHRAE 15, or in this listing.” EPA agrees with the commenters that equipment for professional (*i.e.*, not household or consumer) ice cream appliances is not covered by UL 60335–2–89 and instead follows UL 621, Ice Cream Makers; and as such, ice cream appliances are not covered by this rulemaking. EPA has revised the regulatory text to state that the listings for refrigerated processing and dispensing equipment do not apply to refrigerated processing and dispensing equipment that is within the scope of UL 621 (Ice Cream Makers).

Determining the coverage of UL standards to applications not covered in this rule is outside the scope of this rulemaking. New equipment covered by

the end-uses in this rule must comply with ASHRAE 15 in all instances, and with UL 60335–2–89 where applicable. Further, EPA is allowing for exceptions from the requirement to meet UL 60335–2–89 for equipment that falls outside that standard’s scope, which means that commercial or professional ice cream makers are not required to meet that standard. As described in NOTE 103 in UL 60335–2–89, “This standard does not apply to . . .

- Appliances using flammable refrigerant in transcritical refrigeration systems;
- domestic refrigerating appliances (IEC 60335–2–24);
- motor-compressors (IEC 60335–2–34);
- vending machines (IEC 60335–2–75);
- professional ice-cream appliances (IEC 60335–2–118);
- laboratory refrigerators and freezers (for Canada only. In Canada, the applicable standard for laboratory refrigerators and freezers is CSA C22.2 No. 61010–2–011.)”

Comment: Three commenters requested that EPA clarify the terminology in the proposal, noting that both ASHRAE 15 and UL 60335–2–89 use the term “releasable charge” where EPA used the term “refrigerant charge.” To ensure alignment and minimize confusion, they asked EPA to amend the appropriate terminology used in ASHRAE 15 and UL 60335–2–89 standards. One commenter elaborated that the “releasable charge” is how much refrigerant can be leaked into the space, which could be all of the charge for small systems or the remaining refrigerant after a refrigerant detector identifies a leak and causes safety solenoids to close and isolate refrigerant in larger systems. Similarly, two of these commenters noted that ASHRAE and EPA rely on a different definition of “independent circuit” and asked EPA to align its proposal with the ASHRAE definition.

Response: EPA has clarified the term “releasable charge” in the final risk screens supporting this rule, including amended scenarios with this measure where appropriate. EPA notes that the releasable charge may be used to calculate the maximum allowable charge for each unit or system to which UL 60335–2–89 and/or ASHRAE 15 applies. EPA agrees with the commenter that the releasable charge is the maximum quantity of refrigerant that could be released or leaked into the space. However, we are retaining the proposed term “refrigerant charge capacity” in this rule when referring to charge size limits in the use conditions for R–454A. The charge size capacity is

easily determined by looking at the nameplate for refrigeration equipment, allowing for ease of determining compliance and of enforcing regulations. Further, this allows for consistency with limitations in the 2023 Technology Transitions Rule, reducing confusion for the regulated community.

Regarding the comment on the definition of “independent circuit,” EPA used the term “refrigerant circuit” in the proposed rule and did not use the term “independent circuit.” The Agency has used the term “refrigerant circuit” in previous SNAP regulations concerning flammable refrigerants, as well. ASHRAE’s definition of “independent circuit” is “a closed refrigeration circuit that is arranged in such a manner that, in the event of a single point of failure, the release of refrigerant is limited to only the quantity contained within the refrigeration circuit.” EPA recognizes that the definition of “independent circuit” is consistent with the concept of releasable charge. It is not clear from the comments in which situations the commenters thought that the Agency should be using ASHRAE’s term “independent circuit.” However, in response, in this preamble to the final rule, EPA is clarifying that the charge size or releasable charge requirements apply to each independent circuit. For example, for a cascade system, each of the circuits is independent of the others, and the charge limits apply to individual circuits, not to the entire cascade system.

Comment: Five commenters flagged inconsistencies with regard to the charge sizes mentioned in the proposal. These commenters noted that UL 60335–2–89 allows compressor units, condensing units, and condenser units containing a refrigerant charge over m3 (260 times the LFL) in a machinery room or outdoors in compliance with ASHRAE 15; meaning that this part of the system can exceed 260 times the LFL, if installed in a machinery room or outdoors with additional charge of refrigerant allowed in parts of the system entering an indoor space. One of these commenters provided more in-depth comments detailing specific passages and annexes within the standard for EPA reference. One commenter noted that there is work ongoing between ASHRAE and UL to align requirements and provide clarity as to if just the condensing unit, compressor unit, or evaporating unit must be in a machine room or outdoors (as per UL), or if all refrigerant containing parts must be in a machine room (as per ASHRAE).

Response: EPA thanks the commenters for bringing to our attention the inconsistencies regarding charge sizes mentioned in the proposal as it relates to industry standards and the ongoing work to align those standards. EPA agrees with the commenters that the UL 60335-2-89 standard allows charge over m3 (260 times the LFL) for equipment located in a machinery room or outdoors in compliance with ASHRAE 15. In response to these comments, EPA has edited this language in the final rule by stating in each listing that “These refrigerants may only be used in refrigeration equipment that meets all requirements in UL 60335-2-89,^{1 2 3} except as provided otherwise in UL 60335-2-89, in ASHRAE 15-2022, or in this listing . . .”

Comment: Several commenters referenced industry standards with regard to specific refrigerants. A commenter asked that EPA not allow refrigerant charge limits that exceed U.S. industry safety standards, noting that the table in Appendix R lists HFC-32, R-290, and R-441A as “Acceptable subject to use conditions,” with refrigerant charge limits of 1,000 g, 300 g, or 330 g. However, they asserted that U.S. industry safety standards, such as UL 484, UL 60335-2-40, and ASHRAE 15, do not allow these charge limits. Another commenter generally supported the use of UL 60335-2-89 but noted that the LFL for R-455A was incorrect in the standard’s 2nd edition (0.317 kg/m³) while the 3rd edition of UL 60335-2-89 contains the correct LFL value (0.432 kg/m³). The commenter noted that using the value from the 2nd edition could result in a reduction of allowable charge sizes for R-455A. They suggested EPA refer to the LFL value for R-455A from the ASHRAE 34-2022. Three commenters also supported modified use conditions for hydrocarbons, and specifically R-290, as outlined in UL 60335-2-89. They noted that the standard allows self-contained equipment with more than 150 grams and up to 500 grams of A2L and A3 flammable refrigerants.

Response: EPA did not open for comment the listings for air conditioning and heat pump equipment in appendix R to 40 CFR part 82, subpart G mentioned by the commenter. Rather, those entries were republished “to bring the table in line with the Office of the Federal Register’s general requirement for orderly codification by: adding entry numbers, replacing prohibited language, and properly formatting the footnotes” (87 FR at 45509; July 28, 2022). EPA considers the comment on the content of those

existing listings to be outside of the scope of this rulemaking.

In response to the comment regarding the incorrect LFL value from the standard’s 2nd edition for R-455A, EPA agrees that this value could result in a reduction of allowable charge sizes for R-455A. In this final rule and in EPA’s finalized risk screens, EPA used 0.432 kg/m³ as the LFL for R-455A, which is the value used in ASHRAE 34-2022.

In this final rule, EPA is modifying use conditions for R-290 to allow larger charge sizes for retail food refrigeration—stand-alone units, self-contained retail food refrigeration—refrigerated food processing and dispensing equipment, and self-contained commercial ice machines, consistent with UL 60335-2-89. EPA acknowledges the commenters’ support for these listings.

Comment: Three commenters requested that EPA draft the final rule so that the latest industry standards are always incorporated by reference. The commenters stated that doing so would increase alignment with safety standards while decreasing the need for revisions by EPA. One commenter requested that EPA consider listing additional refrigerants that were not in the proposal to enable the technology transitions proposed under the AIM Act.

Response: Regarding the commenters request regarding an automatic process for updating standards, EPA does not have a process to automatically incorporate future standards into the rules, as the Agency must review each particular iteration of a standard to understand it, determine whether it is appropriate for inclusion in the SNAP rules, and identify whether there are any concerns and if so how to address those. Additionally, EPA has often incorporated industry standards by reference, rather than drafting new language, copying specific language from industry standards, or recommending rather than requiring that industry follow standards. Updating the standard referenced in a SNAP listing involves a change to regulations, and the Agency uses a notice-and-comment rulemaking process to change the standard that is incorporated into regulations. EPA will continue to consider changes to relevant standards, and the Agency may consider whether any revisions to the SNAP program regulations, including considering approaches that do not rely on incorporating standards by reference, should be proposed at a future date.

In response to comments related to listing additional refrigerants that were not in the proposal to enable technology

transitions in regulations under the AIM Act, EPA notes that the requested additional listings are outside the scope of this rulemaking. EPA intends to continue reviewing substitutes under the SNAP program, including refrigerants that may provide more options to comply with regulations issued under the Technology Transitions program, as suggested by the commenters, and consider whether listing of such substitutes is appropriate under SNAP.

Comment: One commenter noted uncertainty related to ASHRAE 15 in that it provides information on the use of A2L refrigerants in large remote systems but does not specify where to place leak detection equipment; for example, whether leaked refrigerant will dissipate or accumulate in particular locations. The commenter stated that the engineer of record designing these applications would need to work through such situations.

Response: EPA agrees that some situations may call for an engineer to decide on the implementation of industry standards, particularly in cases where the standards do not specify information on a particular topic. Uncertainty, however, related to ASHRAE 15-2022 specifications on leak detection is outside the scope of this rulemaking.

Comment: Eight commenters provided input on labeling, markings, and fittings for flammable refrigerants. One commenter added that safety standards like UL 60335-2-40 and UL 60335-2-89 are developed through a consensus process with involvement from a wide variety of stakeholders based on industry research, knowledge, and best practices. One commenter mentioned that multiple standards recognize a class of less flammable gases, such as category 1B flammable gases in the 7th edition of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)—to which OSHA recently harmonized its Hazard Communication Standard. This commenter also stated that fire and building codes such as the International Code Council and the National Fire Protection Association’s compressed gas code recognize the differences between flammability classes 2L and 2 and 3 in ASHRAE 34 and category 1A and 1B flammable gases in the GHS and suggested that EPA should prescribe use conditions according to this distinction to be consistent with international practice, other Federal agencies, industry standards and building codes. Two commenters stated that existing industry standards related to packaging and warning labels are adequate to

address safety concerns associated with A2Ls.

Response: EPA agrees with the commenter that safety standards, like UL 60335-2-40 and UL 60335-2-89, were developed in an open and consensus-based approach, with the assistance of experts in the AC industry as well as experts involved in assessing the safety of products. However, given EPA's stated concern for providing sufficient warning to technicians, end users, the public, and first responders, and our understanding that these groups are not sufficiently represented in the development of the standards, EPA is finalizing use conditions and the Agency concludes that it is appropriate to impose different marking and labeling requirements for A2L refrigerants from those in UL 60335-3-89. The Agency considers these marking and labeling requirements to attract attention and to provide more warning than the approach suggested by the commenters for A2L refrigerants. In response to the comment about consistency with international practice, other Federal agencies, industry standards and building codes that already recognize distinctions between 2L and 2 or 3 flammability classifications, in this final rule we are setting mitigation and charge requirements that recognize distinctions, consistent with UL 60335-2-89 and ASHRAE 15. The additional requirement for red markings and similar labeling requirements to standards with the same wording, but in larger font for A2L refrigerants, will improve visibility of warnings. This approach is the same as that in our previous rules on flammable refrigerants (e.g., 76 FR 78832, December 20, 2011; 80 FR 19454, April 10, 2015; and 86 FR 24444, May 6, 2021).

Comment: Commenters provided comments on specific marking provisions included in the proposed rule. Six commenters noted that EPA's proposal does not align with existing industry standards, namely UL 60335-2-89 and/or UL 60335-2-40, that do not require red markings for mildly flammable refrigerants (i.e., A2Ls) but do require red markings for A2 and A3 refrigerants that have higher flammability. They urged EPA to align with existing standards. Five commenters requested that proposed red marking on pipes, hoses, and other devices for A2L refrigerants be lessened or removed. Three commenters noted that UL has removed this requirement for equipment with A2L refrigerants. Two commenters stated that since A2L refrigerants are much less flammable than A3 refrigerants, the use of red or

colored service port caps would be sufficient for a technician to distinguish between an A2L system and an A3 system (e.g., the flame symbol applied to equipment near all ports for all flammable refrigerants will be an indicator of flammability to technicians). They stated that the red Pantone® marking is justified for A2 and A3 systems, given the significant flammability identified in testing. Another commenter sought to clarify EPA's proposal, stating that the way it currently reads, it would mean that all piping would need to be red. Another commenter asserted that SNAP should require the red tubing markings on all units containing flammable refrigerants, inclusive of all A2L, A2, A3 and B2L units for safety reasons.

A different commenter questioned whether the proposal should be consistent with the SNAP Rule 25 where Red Pantone® #185 was used to indicate the presence of a flammable refrigerant.

Response: EPA is finalizing as proposed to require as a use condition that the listed refrigerants must be used in refrigerating equipment that has red, PMS #185 or RAL 3020 marked pipes, hoses, and other devices through which the refrigerant is serviced, to indicate the use of a flammable refrigerant. EPA had the same requirement in SNAP Rule 25.

Consistent with other rules promulgated under CAA section 612, EPA's requirements of red markings add an extra layer of safety on top of the labels required under the UL standards, and EPA concludes this extra protection is appropriate for this listing under SNAP. As previously noted, these types of red markings would signal to the technician that the refrigerant circuit that she/he was about to access contained a flammable refrigerant, even if all warning labels were somehow removed or were illegible or not understood (e.g., for non-English speakers), and would provide similar notification to consumers, retail store owners, building owners and operators, first responders, and those disposing the appliance. We understand that UL 60335-2-89 treats A2L and A3 refrigerants differently and that red markings are required by the UL standard for A2 and A3 refrigerants, but not for A2L refrigerants. For this SNAP listing, as in our past listings for A3 (and also A2L) refrigerants, EPA concluded that it is most important to warn technicians that there is a flammable refrigerant present, not whether it is specifically an A2L, A2, or A3 refrigerant. Once warned, we would expect the technician to then seek to

know which refrigerant is used and to proceed accordingly. While we understand that the flammability risk can be considered 'lower' when using A2L refrigerants compared to A3 refrigerants because of their higher LFL and higher minimum ignition energy, a risk does exist compared to nonflammable refrigerants. The red markings provide an additional warning to technicians, consumers, retail store owners, building owners and operators, first responders, and those disposing the appliance. We also note that the use of red markings is already required for past actions for flammable refrigerants (76 FR 78832, December 20, 2011; and 80 FR 19454, April 10, 2015; and 86 FR 24444, May 6, 2021), and we are not aware that the marking requirements have led to any confusion.

Concerning the comment that to meet the proposed use condition, all piping would need to be red, EPA does not intend such a broad interpretation of the use condition for red markings. The requirement is intended to mandate red markings of at least one inch in each direction to go on locations such as a servicing port or processing tube. For self-contained equipment that does not have a servicing port or processing tube, a red marking, ring, or sleeve that extends at least one inch in each direction from a location on tubing that is likely or recommended for servicing or recovering refrigerant is sufficient.

EPA is finalizing that such markings apply to these A2L refrigerants as well, to establish a common, familiar, and standard means of identifying the use of a flammable refrigerant. After considering all the public comments on this proposal, we are finalizing this use condition as proposed.

Comment: Five commenters mentioned the labeling requirements as they pertain to SNAP Rules 23 and/or 25. Three commenters asked that EPA remove the labeling requirements from this rule as well as earlier SNAP rules to eliminate inconsistencies with existing standards. One commenter noted concerns around label size, stating that the font must be legible, but not so large that the label cannot fit on the product. They noted that small condensing units have limited space and meeting the existing requirements is a challenge.

Response: EPA agrees with the commenter that the font must be legible and fit on the product. EPA is finalizing that the labels must be provided in letters no less than 6.4 mm (1/4 inch) high, as proposed, as this is a reasonable size even for small condensing units with limited space. The warning labels EPA is finalizing are similar to those

required as use conditions in SNAP Rule 23 and 25 (86 FR 24463, May 6, 2021). Labels indicating flammability risk are critical to assuring proper identification and handling of equipment containing potentially dangerous refrigerants. Using a common set of labels aids in recognition and compliance, especially for a manufacturer that uses more than one refrigerant. EPA also notes that comments requesting changes to requirements in other SNAP rules such as SNAP Rule 23 or 25 fall outside the scope of this rulemaking.

Comment: A commenter stated that EPA's proposal to add a new diamond symbol would unduly burden manufacturers, asserting that the proposed new symbol fails to serve any additional purpose given the presence of the red triangle.

Response: The Agency agrees with the comment that requiring the ISO 7000-W021 flammability warning symbol in addition to the one that is presently required by UL 60335-2-89 may place a burden on manufacturers. As explained by the commenter, the existing edition of UL 60336-2-89, the 2nd edition, requires a red triangle while the 3rd edition under development, which the Agency understands will require a GHS equal-sided diamond with a red outline and a flame symbol on a white background for hazard category 1 flammable gases, is not yet published. The Agency also understands after consulting with fire service groups that the red triangle symbol in the present edition of UL 2-89 may not be immediately recognized in the presence of a flammable refrigerant. This is because a similar black symbol on a yellow triangle would refer first responder fire servicers to a highly reactive oxidizer, rather than a flammable substance. This is relevant because first responders would take different actions for an oxidizer from those for a flammable substance.

Therefore, rather than requiring both symbols at this time, EPA is finalizing to incorporate by reference UL 60335-2-89, with the exception that manufacturers may choose which of the two proposed flammability symbols to use. Manufacturers may choose to include either the red triangle warning symbol required in UL 60335-2-89, 2nd edition, or manufacturers may choose to include the red diamond proposed. At least one of these two symbols must be placed on refrigeration equipment covered by this rule that uses flammable (e.g., A2L or A3) refrigerants. If manufacturers choose to include the red triangle symbol instructed in the 2nd edition of UL 60335-2-89, then all

requirements, including those that refer to placement and size, must be followed accordingly. If manufacturers choose to include the red diamond symbol proposed by EPA, all of the following requirements, including those that refer to placement and size, must be followed accordingly. EPA notes that if the diamond symbol is adopted in the 3rd edition of UL 60335-2-89, manufacturers would be able to use it before the Agency would adopt the 3rd edition, potentially reducing conflicts between EPA's regulations and the UL standard.

Comment: Three commenters requested that EPA increase the charge limits for R-454A in the final rule. One of these commenters requested that EPA not limit the use of R-454A to less than 200 pounds in the IPR, cold storage warehouse, and ice skating rink sectors. The commenter stated that systems in these sectors require charge sizes larger than 200 pounds and that R-454A is a more energy efficient and higher capacity alternative with a GWP of less than 150. The commenter stated that charge limits for systems in these sectors are not restricted by UL 60355-2-89 and that listing and installation requirements of this standard would apply to few systems in industrial occupancies. Another commenter stated that for R-454A applying a 200-pound charge limit is not appropriate. Another of these commenters noted that the proposal stated that the 200-pound limit for use of R-454A in remote condensing units and supermarkets is inconsistent with ASHRAE 15 and UL 60335-2-89. The commenter stated that systems following both of the standards could have charge sizes greater than 260 times the LFL, or 200 pounds, if the releasable charges in an indoor space did not exceed either standard's limits. They requested that EPA harmonize with UL 60335-2-89 and ASHRAE 15 on charge limits rather than imposing a charge limit distinct from the safety standards. This commenter also provided comments on use conditions for R-454A. A third commenter requested that EPA include language specifying the allowance of an "unlimited charge" of R-454A in cold storage and the high-temperature side of cascade systems.

Response: EPA acknowledges that the 200-pound limit for remote condensing units and supermarkets may be inconsistent with ASHRAE 15 and UL 60335-2-89. EPA recognizes that systems following either of these standards could have charge sizes up to 260 times the LFL, which under certain circumstances may exceed 200 pounds if the releasable charge in an indoor space does not exceed either standard's

limit. However, EPA disagrees that the 200-pound limit should be implemented through using the charge limits that flow out of UL 60335-2-89 or ASHRAE 15. By requiring this charge limit as its own use condition separate from the standards, EPA is highlighting that this charge limit applies, even for use outdoors or in a machinery room. The Agency is requiring this use condition specifically for R-454A so that users may select lower-GWP refrigerants such as R-290, R-454C, R-455A, R-457A, R-516A, or R-744 with GWPs from one to 150, for use in locations that are not space constrained, such as in machinery rooms or outdoors; the use condition still allows use of the higher-GWP and higher volumetric capacity refrigerant R-454A in space-constrained locations. Also see responses explaining EPA's rationale for listing R-454A for supermarket systems and remote condensing units with a use condition that refrigerant charge capacity be less than 200 pounds in sections II.A.6 and II.F.6 of this preamble.

EPA intends in this rule to differentiate between smaller systems that are used in occupied spaces with public access, where the greater volumetric capacity of R-454A is needed to fit into more constrained spaces, versus less constrained (or unconstrained) spaces, such as outdoors or in machinery rooms. R-454A has a higher GWP than most of the other refrigerants that EPA is listing in this rule-237 compared to 150 or less—and has a greater volumetric capacity, as pointed out by the commenters. Thus, it is best used in those situations where it may be more difficult to use other alternatives with even lower GWPs because size constraints are greater—namely, where charge sizes would be less than 200 pounds. In highly constrained spaces, however, refrigerants with lower volumetric capacity and lower GWP may not technologically provide sufficient performance, only allowing the use of a higher-GWP refrigerant, like R-454A. In situations that are less space constrained and where only the ASHRAE 15 standard governs, such as in machinery rooms or outdoors, other refrigerants with lower GWP and lower volumetric capacity may be used and would reduce overall risk to human health and the environment more than R-454A. Therefore, EPA disagrees with commenters' requests to allow charge sizes greater than 200 pounds of R-454A in IPR and cold storage warehouses. EPA elaborates that although the charge limits for some systems in these sectors are not

restricted by UL 60335–2–89 for industrial occupancies and could exceed the 200-pound threshold, under the Technology Transitions Rule (88 FR 73098, October 24, 2023), refrigerants with a GWP between 150 and 300 can still be used in accordance with the Technology Transitions Rule for charges less than 200 pounds in IPR, supermarket systems, remote condensing units, and cold storage warehouses, as well as for the high-temperature side of a cascade system. In light of this limitation and after consideration of the commenters' requests that EPA include language specifying the allowance of an "unlimited charge" of R-454A in cold storage and the high-temperature side of cascade systems, EPA is listing R-454A as proposed in those end-uses. EPA clarifies that there is not a charge size limit on R-454A in the high-temperature side of a cascade system for any of the end-uses in this final rule, except to the extent that such a limit would be needed to be consistent with UL 60335–2–89 or ASHRAE 15.

For the ice skating rinks end-use, EPA notes that the Agency did not propose to list R-454A as acceptable, either with or without a charge size limit. See section II.G.6 of this preamble concerning comments on listing R-454A as acceptable in ice skating rinks.

I. Exemption for R-290 From the Venting Prohibition Under CAA Section 608 for Refrigerated Food Processing and Dispensing Equipment

1. What is EPA's final determination regarding whether venting, releasing, or disposing of R-290 in refrigerated food processing and dispensing equipment would pose a threat to the environment?

Under section 608(c)(2) of the CAA, 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 substitute substance for a class I or class II substance used as a refrigerant in such appliance (or IPR) in a manner which permits such substance to enter the environment. Under section 608(c)(2), this prohibition applies to any substitute refrigerant unless the Administrator determines that such venting, releasing, or disposing does not pose a threat to the environment. As discussed in section II.B of this preamble, EPA is listing the refrigerant substitute R-290 under the SNAP program as acceptable, subject to use conditions, in newly manufactured refrigerated food processing and dispensing equipment. EPA is also

exempting R-290 in this end-use from the venting prohibition under CAA section 608(c)(2), on the basis of existing evidence that the venting, release, or disposal of this substance in this end-use and subject to the use conditions in this final action does not pose a threat to the environment. Further, as discussed in greater detail below, this exemption is consistent with decisions in past rulemakings to exempt R-290 in other specific end-uses from the venting prohibition under CAA section 608(c)(2), and it reflects EPA's concern that there is not yet sufficient recovery equipment suitable for use with highly flammable (A3) refrigerants.

For purposes of CAA section 608(c)(2), EPA considers two factors in determining whether or not venting, release, or disposal of a substitute refrigerant during the maintenance, servicing, repairing, or disposing of appliances poses a threat to the environment (69 FR 11948, March 12, 2004; 79 FR 29682, May 23, 2014; 80 FR 19453, April 10, 2015; and 81 FR 86778, December 1, 2016). First, EPA analyzes the threat to the environment due to inherent characteristics of the refrigerant substitute, such as GWP or photochemical reactivity. Second, EPA determines whether and to what extent such 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.

Potential Environmental Impacts

EPA has evaluated the potential environmental impacts of releasing into the environment R-290, a substitute refrigerant that we are listing in this rule as acceptable, subject to use conditions, in refrigerated food processing and dispensing equipment. We assessed the potential impact of the release of R-290 on local air quality and its ability to decompose in the atmosphere to form ground-level ozone, its ODP, its GWP, and its potential impacts on ecosystems. We found that the magnitudes of these impacts were not large enough to pose a threat to the environment. R-290's ODP is zero, and its GWP is approximately three. R-290 is highly volatile and typically evaporates or partitions to air, rather than contaminating surface waters. Thus, R-290's effects on aquatic life are expected to be small.

As to potential effects on local air quality, R-290 meets the definition of

VOC under CAA regulations (40 CFR 51.100(s)) and is not excluded from that definition for the purpose of developing SIPs to attain and maintain the NAAQS. R-290's maximum incremental reactivity (MIR) of 0.56 g O₃/g R-290 is higher and more reactive than that of ethane (MIR of 0.26 g O₃/g ethane), which EPA uses as a threshold to determine whether substances may have negligible photochemical reactivity in the lower atmosphere (troposphere). EPA performed air quality modeling on a number of scenarios to determine whether emissions of HC refrigerants could have a significant impact on local air quality, particularly in certain cities with particularly difficult challenges in achieving attainment of the NAAQS for ground-level ozone. The comparison of HC refrigerant emissions was matched to the level of the NAAQS for the purposes of illustrating that the even under a worst-case scenario the projected impacts on ground-level ozone are small. Based on the analysis and modeling results described in section II.B.3 of this preamble, EPA concludes that the release of R-290 from the refrigerated food processing and dispensing end-use, in addition to the HCs previously exempted from the venting prohibition and 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 found particularly noteworthy that even assuming 100 percent market penetration of R-290 and the other acceptable HCs in the acceptable end-uses, which is a conservative assumption, the highest impact for a single 8-hour average ozone concentration based on that analysis would be 0.05 ppb in Los Angeles, 0.008 in Houston, and 0.005 in Atlanta compared to the level of the 2015 ozone NAAQS at 70 ppb.⁸¹ The highest impact refers to the greatest amount of ground-level ozone that could be created by the release of R-290 and other HC refrigerants under the analysis' most conservative scenarios.

In addition, EPA examined all HC substitute refrigerants in those uses for which UL currently has standards in place for flammable refrigerants, for which the SNAP program has already listed the uses as acceptable, subject to use conditions, and for which the SNAP program is reviewing a submission, including the one in this action. We found that even if all the HC refrigerant substitutes in appliances in end-uses

⁸¹ ICF, 2016. Additional Follow-on Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. September, 2016.

listed acceptable, subject to use conditions, in this action and listed as acceptable in previous rules were to be emitted, as well as two hydrocarbon refrigerants that EPA ultimately listed as unacceptable in certain end-uses, there would be a worst-case impact of less than 0.15 ppb for ground-level ozone in the Los Angeles area.⁸² The use conditions established in the prior SNAP listings limited the total amount of R-290 in each refrigerant circuit to 60 g or less (for water coolers) or 150 g or less (for other end-uses), depending on the end-use. Changes in standards that are incorporated by reference as use conditions (requirements) in the final SNAP listings in this rule would allow maximum charge sizes of R-290 up to 494 g in retail food refrigeration-stand-alone units and retail food refrigeration-refrigerated food processing and dispensing equipment, and self-contained commercial ice machines. The analyses also assume R-290 and other, more reactive HC refrigerants, may also be used in these end-uses, so our analysis assuming complete market penetration of HCs is conservative.

EPA also has performed more recent air quality analysis before the publication of this rule, considering additional end-uses and refrigerants that have been listed acceptable more recently (e.g., R-1150 in very low temperature refrigeration), looking out to 2040, and using updated models.⁸³ EPA found that the revised air quality models showed slightly greater impacts compared to our 2014 and 2016 analyses in all scenarios. For example, in the worst-case scenarios where the most reactive HC refrigerant reviewed, propylene, was used broadly across the refrigeration and AC industry, the worst-case increase in ground-level ozone was 8.62 ppb in Los Angeles in the 2022 analysis compared to 7.8 ppb in Los Angeles in an analysis in 2016 looking at the same scenario with the same refrigerant. EPA made this comparison to see if that refrigerant, which the SNAP program had previously listed as unacceptable in certain end-uses due to its potential air quality impacts, would have similar, greater, or less impact using the updated model for the same scenario compared to the earlier version of the model. Changes to the Community Multiscale

Air Quality (CMAQ) model, more updated refrigerant emissions estimates from EPA's Vintaging Model, as well as the longer time-period considered, resulted in the changes. The 2016 analysis found that even assuming 100 percent market penetration of R-290 and the other acceptable HCs in the end-uses where they are already listed as acceptable, subject to use conditions, or were under review, which is a conservative assumption, the highest impact for a single 8-hour average ozone concentration based on the 2016 analysis would be 0.05 ppb in Los Angeles and less than 0.01 ppb in Houston and Atlanta.⁸⁴ Looking at the 2022 analysis, in the scenarios that estimated emissions assuming that HC refrigerants listed as acceptable, subject to use conditions, reached 100 percent market penetration, the worst-case increase in ground-level ozone in Los Angeles was 0.012 ppb, in Houston was 0.009 ppb, and in Atlanta was 0.006 ppb. Unlike the 2014 and 2016 analyses, the 2022 analysis did not include modeling of propylene or the propylene blend R-443A in certain end-uses, as those refrigerants were listed as unacceptable in SNAP Rule 21 (81 FR 86778, December 1, 2016). For purposes of the analysis under CAA section 608(c)(2), the Agency considers the modeled changes to ground-level ozone levels to be extremely small. For instance, the modeled impacts on daily maximum 8 hour average ozone concentrations are less than 0.017 percent of the level of the 2015 ozone NAAQS of 70 ppb.⁸⁵ EPA considers the 2022 modeling to further support the Agency's earlier conclusions in 2015 and 2016 that use of saturated HCs as refrigerants, including release of R-290, R-600a, and R-441A during repairing, maintaining, servicing, or disposing of appliances, would not result in a significant increase in ground-level ozone, for purposes of determining whether to exempt these refrigerants in specific end-uses from the venting prohibition under CAA section 608(c)(2).

Considering our evaluation of these potential environmental impacts, EPA concludes that R-290 in the refrigerated food processing and dispensing end-use 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-use.

Authorities, Controls, or Practices

The determination of whether venting, release, or disposal of a substitute refrigerant poses a threat to the environment includes considering whether such venting, release, or disposal is adequately controlled by other authorities, regulations, or practices. EPA expects that existing authorities, controls, and/or practices will mitigate environmental risk from the release of R-290. Analyses performed for both this rule and the SNAP rules issued in 1994, 2011, 2015, and 2016 (59 FR 13044, March 17, 1994; 76 FR 38832, December 20, 2011; 80 FR 19453, April 10, 2015; and 81 FR 86778, December 1, 2016, respectively) indicate that existing regulatory requirements and industry practices limit and control the emission of R-290. For reasons discussed in proceeding paragraphs, EPA concludes that the limits and controls under other authorities, regulations, or practices adequately control the release of and exposure to R-290 and mitigate risks from any possible release.

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 Sections II.B.7, "What updates to existing use conditions for stand-alone units is EPA finalizing?" and II.D.5, "What updates to existing use conditions for commercial ice machines is EPA finalizing?" we note that the amount of R-290 from a refrigerant loop is effectively limited to roughly 500 g or 300 g in the end-uses listed in this rule. This indicates that HC emissions from such uses are likely to be relatively small.

As discussed in Section II.B.3, "What is R-290 and how does it compare to other refrigerants in the refrigerated food processing and dispensing equipment end-use category?" EPA's SNAP program evaluated the flammability and toxicity risks from R-290 in the new end-use in this final rule. EPA is providing some of that information in this section as well, to provide information on the potential for leaks and exposure due to R-290.

R-290 is classified as an A3 refrigerant by ASHRAE 34-2022 and

⁸² ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February 2014.

⁸³ ICF, 2022. Additional Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. May 2022. Updated models included VM IO file_v5.1_10.01.19 and CMAQ 5.2.1 with carbon bond 06 (CB06) mechanism, as cited in ICF, 2022.

⁸⁴ ICF, 2016. Additional Follow-on Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. September 2016.

⁸⁵ ICF, 2020. *Op cit*.

subsequent addenda, indicating that it has low toxicity and high flammability. R-290 has an LFL of 2.1 percent. To address flammability risks, this document provides recommendations and use conditions for its safe use (see Section II.H.2, “What additional information is EPA including in these listings?”). The SNAP program’s analysis finds that the use conditions in this 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 use conditions in this final rule will 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.

The release and/or disposal of many refrigerant substitutes, including R-290, are controlled by other authorities including various standards and State and local building codes. The industry consensus safety standard UL 60335-2-89, which EPA is incorporating by reference in use conditions in the SNAP listing for R-290 in refrigerated food processing and dispensing equipment, is one of these standards, and industry also applies the standard ASHRAE 15. Code-making organizations, such as the International Code Council (ICC), are in the process of updating references to the most recent industry standards that address use of R-290 and other flammable refrigerants in the International Building Code (IBC). The specific editions of UL 60335-2-89 and ASHRAE 15 that are incorporated in this rulemaking as use conditions are in the process of being adopted in the next version of the IBC; once the IBC adopts those standards, State and localities may adopt those revisions into their State or 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 R-290 are sufficiently protective. These practices and controls mitigate the risk to the environment that may be posed by the venting, release, or disposal of R-290 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 R-290 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.

2. What is EPA’s final determination regarding whether venting of R-290 from refrigerated food processing and dispensing equipment is exempted from the venting prohibition under CAA section 608(c)(2)?

Consistent with the listing under SNAP in this action, EPA determines that venting, releasing, or disposing of R-290 in refrigerated food processing and dispensing equipment is not expected to pose a threat to the environment during the maintaining, servicing, repairing, or disposing of appliances. As discussed in section II.A.1 of this preamble, EPA is making this determination on the basis of the inherent characteristics of this substance, the limited quantities used in the relevant end-use, and the limits and controls under other authorities, regulations, or practices that adequately control the release of and exposure to R-290 and mitigate risks from any possible release. Accordingly, EPA is revising the regulations at 40 CFR 82.154(a)(1) to add R-290 in this end-use to the list of substitute refrigerants that are exempt from the venting prohibition under CAA section 608(c)(2).

3. When will the exemption from the venting prohibition apply?

This exemption for R-290 in refrigerated food processing and dispensing equipment applies 30 days after the publication of this final rule in the **Federal Register**, on and after July 15, 2024. This is the same as the effective date of the SNAP listing of R-290 in refrigerated food processing and dispensing equipment.

4. What is the relationship between this exemption under CAA section 608(c)(2) and other EPA rules?

This final exemption from the CAA section 608(c)(2) venting prohibition does not mean that R-290 used in refrigerated food processing and dispensing equipment can be vented in all situations. R-290 released or otherwise disposed of from commercial and industrial appliances is likely to be hazardous waste under RCRA (see 40 CFR parts 260 through 270). As discussed in the final rules addressing the venting of ethane (R-170), R-600a, R-290, 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; 81 FR 86778, December 1, 2016). 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*. For commercial appliances such as refrigerated food processing and dispensing equipment, it is likely that R-290 and other flammable HC refrigerant substitutes would be classified as hazardous waste, and recycling, reclamation or disposal of R-290 from such appliances would need to be managed as hazardous waste under the RCRA regulations (40 CFR parts 260 through 270), unless it is subject to a limited exception in those regulations if the ignitable refrigerant is to be reused without first being processed to remove contamination.

5. How is EPA responding to comments on the exemption for R-290 from the venting prohibition?

Comment: Four commenters suggested that R-290 should not be exempt from the CAA section 608 venting prohibition. Three of these commenters were in favor of applying section 608 to all refrigerants, including hydrocarbons. One of these commenters supported a prohibition on venting due to R-290’s flammability hazards. Another commenter noted the flammability concern when larger charge sizes are involved. A different commenter further specified that R-290’s flammability and safety concerns could be magnified with charge sizes of 494g allowed by UL 60335-2-89 and potentially other U.S. standards based on proposed updates (e.g., ASHRAE 15.2). One commenter noted flammability concerns related to system designs for hydrocarbon refrigerants. They specified that in these systems, venting does not typically remove all the refrigerant and the residual hydrocarbon refrigerant can create flammability concerns if the system is brazed or welded.

Response: For the reasons discussed in Section II.I of this preamble, “Exemption for R-290 from the venting prohibition under CAA section 608 for refrigerated food processing and dispensing equipment,” EPA disagrees with the commenters and finds that venting, release, or disposal of R-290 in the retail food refrigeration—refrigerated food processing and dispensing end-use and subject to the use conditions listed in this action does not pose a threat to

the environment. EPA's decision is based on consideration of multiple environmental characteristics. The comments do not provide sufficient analysis to support a reason for EPA to change our proposed conclusion that the venting permitted by this exemption of these refrigerant substitutes in these end-uses, subject to the required use conditions, do not pose a threat to the environment, or to change this final rule so that they would not be exempt from the venting prohibition. EPA evaluated risk associated with scenarios with charge sizes larger than 494 g in stand-alone units and refrigerated food processing and dispensing equipment and concluded that R-290 is acceptable for these specific end-uses with use conditions according to industry standards. For example, flammability risks can be addressed for stand-alone units and refrigerated food processing and dispensing equipment by installing the equipment in a space with appropriate capacity and charge size for the intended area, and following manufacturer guidelines and safety standards (ASHRAE 15, ASHRAE 34, UL 60335-3-89). EPA also notes that its evaluation of substitutes is based on the information currently available; proposed updates that are not yet released did not factor into the listings of this rule. As discussed in the use conditions for R-290, venting is allowed during the maintenance, servicing, repair, or disposal of specific appliances, like stand-alone and refrigerated food processing and dispensing equipment. Regarding the commenter's concern that venting does not typically remove all the refrigerant from these systems, EPA responds that proper handling and flammability warning labels as described in section II.H of this preamble serve a preventative role by notifying trained personnel handling equipment about the presence of a flammable refrigerant, even in the unlikely event that there would be a sufficient residue of R-290 left after venting to create a flammability risk. EPA has also made the same finding for R-290 in the past, as well as for other alkane refrigerants (e.g., R-600a, R-441A). EPA recognizes that there are flammability risks both during venting and during use of recovery equipment with A3 refrigerants; until the refrigeration and air-conditioning industry has further development and market penetration of recovery equipment with non-sparking components, the flammability risks of potentially using inappropriate recovery equipment with R-290 may be greater

than the flammability risk of controlled releases of R-290 outdoors.

In addition, EPA's exemption from the CAA venting prohibition of these substances in these end-uses is consistent with how other countries, including Australia, Japan, and those in the European Union, regulate the venting of hydrocarbons.

Comment: Four commenters drew comparisons between R-290 and other refrigerants or classes of refrigerants. Three of these commenters expressed concern that allowing the venting of one type of flammable refrigerant may cause confusion in the industry as the use of low-GWP refrigerants becomes widespread. One commenter noted that if EPA's rationale for exempting R-290 is its low GWP, then HFOs should likewise be exempt. This commenter also stated that unlike R-290, HFOs are not VOC and do not contribute to ground-level ozone. A different commenter raised a climate impact concern due to the reactivity of R-290 to form ground-level ozone, which is also a greenhouse gas, and thus R-290 should not be exempted from refrigerant recovery requirements. A different commenter noted that if hydrocarbons become more widely used, volumes of hydrocarbons vented could increase; while hydrocarbons generally have low GWPs, the GWP values do not take into account the total emissions from the supply chain.

Response: In response to comments about confusion over venting only one type of flammable refrigerant, EPA notes that technicians should already be aware of these differences for other types of self-contained equipment using R-290, R-600a, or R-441A, and this would not change substantially for refrigerated food processing and dispensing equipment, which is less common than those other types of self-contained equipment. Further, it is EPA's understanding that it is relatively uncommon for self-contained equipment to be serviced, compared to equipment with remote compressors, so removing R-290 from equipment would typically occur at disposal of the equipment.

Concerning the comment suggesting that EPA should also exempt HFOs, EPA did not propose and is not finalizing an exemption for HFOs from the CAA prohibition to knowingly vent or otherwise knowingly release refrigerants. EPA disagrees with the comment that R-290's low GWP is the sole reason EPA is exempting R-290 from the venting prohibition. EPA has discussed in this section the multiple factors that it considers, and the fact that HFOs are subject to the venting

prohibition is irrelevant to the R-290 analysis. Further, if EPA were to evaluate exempting one or more HFOs in a particular end-use from the venting prohibition, that analysis would appropriately focus on the inherent characteristics and other authorities, practices and controls that are relevant to HFOs in that end-use, not on the analysis for R-290, which differs from HFOs in some respects, such as with respect to flammability risks and availability of appropriate recovery equipment. In response to the comment that there is a climate impact from formation of ground-level ozone, EPA acknowledges that ground-level ozone is a greenhouse gas; however, given the small additional amounts of ground-level ozone that EPA has calculated would be generated, even in the worst case, the additional climate impact is negligible. Concerning the comment regarding indirect climate impacts from emissions along the supply chain, EPA acknowledges that there are also other climate impacts in addition to direct GWP of emissions of a substitute. However, there would also be the same indirect climate impacts from emissions along the supply chain, whether EPA exempts R-290 in refrigerated food processing and dispensing equipment from the CAA 608(c)(2) venting prohibition or not. The Agency has addressed the possibility of greater use of HC refrigerants by conservatively assuming complete market penetration (i.e., being the only refrigerants used) in all end-uses where there has been interest in the use of hydrocarbons to date. Thus, after considering public comments received, EPA's conclusions concerning exempting R-290 in refrigerated food processing and dispensing equipment remain the same and EPA is finalizing as proposed.

Comment: A couple of commenters noted concerns related to the status of R-290 as a VOC. One commenter stated that HC refrigerants are VOC and can impact local air quality particularly in densely populated areas that are likely to have the most air conditioning and refrigeration equipment. Another commenter expressed concern for the apparent inconsistency presented by the proposed exemption of R-290 from the CAA section 608(c)(2) venting prohibition versus other EPA regulations where R-290 is not considered VOC-exempt (i.e., is not excluded from the definition of VOC for the purpose of developing SIPs to attain and maintain the NAAQS). This commenter stated that R-290 has a MIR value more than twice the MIR of ethane, which EPA has used as a

reference point for determining whether to allow a substance to obtain an VOC exemption. This commenter stated that the EPA should use the same approach to determine whether propane should be exempt from the CAA section 608(c)(2) venting prohibition as whether it should be VOC-exempt. The commenter stated that using a “worst-case impact approach” is inconsistent with previous approaches that determined VOC exemptions based on information showing that 1) VOC are of low photochemical reactivity and they can be ignored in oxidant control programs, or that 2) compounds more reactive than ethane continue to be considered VOC for regulatory purposes.

Response: In response to these comments, EPA notes that the second commenter fails to recognize the distinctions between two different regulatory provisions. To the extent the comments relate to whether propane should be excluded from the definition of VOC (see 40 CFR 51.100(s)) for the purpose of addressing the development of SIPs to attain and maintain the NAAQS, they are beyond the scope of this rulemaking and require no further response. EPA did not reopen and is not making any changes to 40 CFR 51.100(s) in this action.

EPA’s regulations under 40 CFR part 82, subpart F prohibit individuals from knowingly venting or otherwise releasing into the environment ozone-depleting substances or their substitutes used as a refrigerant while maintaining, servicing, repairing, or disposing of appliances or industrial process refrigeration. See 40 CFR 82.154. Consistent with section 608(c)(2) of the CAA, EPA has established regulatory exemptions from this prohibition for certain refrigerants used in specific end-uses where EPA has determined that the release does not pose a threat to the environment. The Agency considers multiple factors on a refrigerant-by-refrigerant basis before deciding to establish such an exemption from the venting prohibition under 40 CFR 82.154. EPA has previously established exemptions from the venting prohibition for propane in particular end-uses. See 40 CFR 82.154(a)(1)(viii) (exemption for R–290 in retail food refrigerators and freezers (stand-alone units only); household refrigerators, freezers, and combination refrigerators and freezers; self-contained room air conditioners for residential and light commercial air-conditioning and heat pumps; vending machines; and self-contained commercial ice machines, very low temperature refrigeration equipment, and water coolers). Among

other things, in establishing these exemptions EPA has described the analysis supporting its determination that venting, releasing, or disposing of propane in the particular end-uses at issue does not pose a threat to the environment, and it has explained that the controlled release of propane outdoors may be the safest option in certain circumstances as many recovery machines are not equipped to properly recover highly flammable refrigerants (e.g., recovery machines without spark proof components).⁸⁶ EPA is taking a similar approach here and its conclusions are consistent with those prior EPA actions. The potential environmental impact of releases of propane and other HC refrigerants in multiple analyses, as described above in section II.I.1 of this preamble. We considered the inherent characteristics of these substitute refrigerants and the limited quantities used in the relevant applications. Those analyses show that use of saturated HCs as refrigerants, including release of R–290, R–600a, and R–441A during repairing, maintaining, servicing, or disposing of appliances, would not result in a significant increase in ground-level ozone. Based on this review, EPA concludes that the venting, releasing, or disposing of propane in these end-uses and subject to these use conditions are not expected to pose a threat to the environment.

Regarding both commenters’ concerns with propane’s status as a VOC and the first commenter’s concerns regarding the potential for local air quality impacts, the Agency clarifies that even if a substance is defined as a VOC under 40 CFR 51.100(s), it can still be exempted from the venting prohibition under CAA section 608 and 40 CFR 82.154, if the appropriate determination under CAA section 608(c)(2) is made. While EPA may consider a substance’s status as a VOC under CAA regulations (40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS in making that determination, that may not be the sole or determinative factor in making a determination under section 608(c)(2), as other factors may also affect whether such venting poses a threat to the environment. EPA’s prior decisions to provide a limited exemption to the venting prohibition for R–290, and other refrigerants that are VOC under the Agency’s regulatory definition under CAA regulations (40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS, in particular end uses are examples of this result. In those situations, EPA also

evaluated potential local air quality impacts using conservative assumptions and has provided a limited exemption from the venting prohibition for these substitutes in these end-uses under section 608(c)(2) of the CAA because the Agency concluded that it was appropriate to make the statutory determination that supports the exemption from the venting prohibition. EPA is taking a similar approach here, as described above in section II.I.1 of this preamble, and is reaching the same conclusion.

Comment: One commenter expressed concern that EPA has arbitrarily set a “de minimis” part per billion level (i.e., 0.15 ppb resulting from the Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations (ICF, 2014) for purposes of evaluating the ozone impacts of this rule. The commenter also notes that there is no such impact threshold applied by EPA when considering whether State Implementation Plans (SIPs) adequately address sources within a State that may contribute to nonattainment or interference with maintenance of the NAAQS implying that EPA should not use an ozone impact threshold for the purposes of evaluating the impacts of this rule.

Response: EPA disagrees with the commenter that the incremental value from the 2014 analysis of 0.15 ppb was applied as an arbitrary “de minimis” threshold for evaluating local ozone impacts. EPA used the 2014 analysis containing the 0.15 ppb value in previous SNAP rulemakings listing HC refrigerants, as well as for this rulemaking, to illustrate that even the worst-case impact from HC refrigerants, including R–290, would be small. These analyses were considered as part of the overall evaluation of risks to human health and the environment that supported certain listing decisions in this rule, as discussed above. More recent analyses were performed prior to this rule’s development and came to similar conclusions that potential local air quality impacts of emissions of saturated hydrocarbons used as refrigerants would be small; these analyses are in the docket for this rulemaking. For the SNAP program, as part of the analysis under 40 CFR 82.180(a)(7), the Agency considers whether there will be increased overall risk to the population due to ambient exposure to increased ground-level ozone as a result of using the alternative refrigerants in the final rule, among several other criteria. The commenter appears to conflate the requirements for evaluating air quality impacts and general population risk due to exposure

⁸⁶ 81 FR 86778 at 86801.

to increased ground-level ozone for the purpose of SNAP with the requirements for developing State Implementation Plans to implement the NAAQS. The two are unrelated. This rule has no effect on development of State Implementation Plans or other aspects of NAAQS implementation, and to the extent comments are related to those subjects, they are beyond the scope of this rulemaking and require no further response. Finally, as described in this preamble, the more recent air quality modeling performed in 2022 demonstrated that the largest worst-case increase in ground-level ozone due to use of acceptable HC refrigerants was 0.012 ppb, which is even lower than the worst-case value, 0.15 ppb, from previous analysis in 2014. For purposes of a benchmark for comparison, the level of the 2015 NAAQS, which is currently in effect, is 70 ppb (as the fourth-highest daily maximum 8-hour concentration, averaged across three consecutive years), more than four orders of magnitude higher.

Comment: One commenter suggested that EPA align its RCRA regulations to allow for the venting of R-290 and the other flammable refrigerants as allowed under 40 CFR 82.154(a). The commenter noted that most of the refrigerated food processing and dispensing end-use appliances will not be in household locations; therefore, these appliances will not fall under the RCRA household exemption, and the refrigerant cannot be vented due to RCRA regulations. The commenter added that R-290 from the refrigerated food processing and dispensing end-use will be required to be managed as hazardous waste (characteristic of ignitability) (e.g., recovered and managed as RCRA hazardous waste as opposed to venting).

Response: EPA did not propose to revise regulations issued under RCRA in this rulemaking, and thus the request to revise those rules is outside the scope of this rulemaking.

J. How is EPA responding to other comments?

Comment: Nine commenters broadly supported Proposed Rule 26. One commenter added that choice of alternatives is an important factor regarding assuring economic success of the ozone protection program, and they are generally supportive of proposed decisions that offer flexibility of choice and improve overall environmental performance. Another commenter indicated that they support EPA's application of the new refrigerants to cold storage warehouses, ice skating rinks, and industrial processes. A different commenter supported the

Agency's efforts to further enable lower-GWP solutions in the end-uses regulated under the SNAP program but proposed that standard clarifications, listing of additional substitutes, use condition modifications, and R-290 venting prohibitions should be included in the final SNAP Rule 26 to advance the safe and orderly transition to lower-GWP solutions. These commenters' detailed comments appear under the appropriate section headings within this document.

Response: EPA acknowledges the commenters' support of the listings in this rulemaking. EPA is finalizing many listing decisions as proposed and is finalizing other listing decisions with relatively minor changes that address and incorporate information provided in comments as described throughout the preamble. EPA acknowledges the commenter's concern for the GWPs of various refrigerants and for the commenter's recognition that new alternatives will be more widely adopted in the future. EPA plans to continue to review substitutes consistent with the SNAP program criteria, including atmospheric impacts such as GWP impacts. EPA addresses comments about standard clarifications and use conditions in section II.H.2 of this preamble and R-290 exemptions in section II.I.5 of this preamble.

Comment: One commenter noted support for listing HFO-1234yf. The commenter stated that industry has made significant investments in research and development, and expanded capacity for production of HFO refrigerants, which are used as refrigerants or components in refrigerant blends.

Response: EPA acknowledges the commenter's support for listing HFO-1234yf in this rulemaking. EPA is finalizing acceptable listings for HFO-1234yf as proposed.

Comment: A different commenter provided detailed comments cautioning against listing HFO-1234yf due to environmental and public health concerns. This commenter stated that HFO-1234yf stands apart from the other substitutes because of a higher toxicity concern. They mentioned a by-product of breakdown called trifluoroacetic acid (TFA)—a substance they described as a per- and polyfluoroalkyl substance (PFAS). They stated that these short-chain PFAS are widely detected, persistent, and mobile in aquatic systems. The commenter noted that the TFA yield for HFO-1234yf (1.0) is higher than that of HFC-134a (0.2). They asserted negative impacts of TFA include toxicity to plants, harm to aquatic organisms, and potential harm to human and ecosystem health. The

commenter urged EPA not to list HFO-1234yf as there are other safer alternatives available for cold storage, IPR, commercial ice machines, food retail, chillers, ice skating rink and other end-uses, including low global warming potential hydrocarbons, carbon dioxide, and ammonia.

Response: EPA appreciates the information provided by a commenter on the atmospheric decomposition of HFO-1234yf to TFA. We note that several studies and reports provide further information about this topic. A 2014 study by Kazil, et al. analyzed TFA deposition in the United States assuming 100 percent of all motor vehicle air conditioning systems use HFO-1234yf, which was the largest use of HFO-1234yf at that time.⁸⁷ The results indicated that rainwater TFA concentrations, while varying strongly geographically, would on average be low compared to the levels at which toxic effects are observed in aquatic systems. Similarly, low TFA concentrations were estimated for emissions of HFO-1234yf from Asia in a 2021 study by David, et al.⁸⁸ The World Meteorological Organization (WMO) also provided a summary of key information pertaining to TFA in their 2022 report to the Montreal Protocol.⁸⁹ The report states:

The formation in the atmosphere of trifluoroacetic acid (TFA) is expected to increase in the coming decades due to increased use of HFOs and HCFOs. TFA, a breakdown product of some HFCs, HCFCs, HFOs and HCFOs, is a persistent chemical with potential harmful effects on animals, plants, and humans. The concentration of TFA in rainwater and ocean water is, in general, significantly below known toxicity limits at present. Potential environmental impacts of TFA require future evaluation due to its persistence. (p. 14)

Most TFA currently found in the environment resulting from decomposition of refrigerants likely

⁸⁷ Kazil et al., 2014. "Deposition and rainwater concentrations of trifluoroacetic acid in the United States from the use of HFO-1234yf" J. Kazil, S. McKeen, S.-W. Kim, R. Ahmadov, G.A. Grell, R.K. Talukdar, A.R. Ravishankara. *JGR Atmospheres*. Volume 119, Issue 24. December 27, 2014. Pages 14,059–14,079. October 31, 2014. Available online at <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2014JD022058>.

⁸⁸ David et al., 2021. "Trifluoroacetic acid deposition from emissions of HFO-1234yf in India, China, and the Middle East," Volume 21, issue 19. *Atmos. Chem. Phys.*, 21, 14833–14849, 2021. <https://doi.org/10.5194/acp-21-14833-2021>. Available online at <https://acp.copernicus.org/articles/21/14833/2021>.

⁸⁹ WMO, 2022. Executive Summary. Scientific Assessment of Ozone Depletion: 2022, GAW Report No. 278, 56 pp.; WMO: Geneva, 2022. Available online at <https://ozone.unep.org/system/files/documents/Scientific-Assessment-of-Ozone-Depletion-2022-Executive-Summary.pdf>.

derived from HFC-134a, which is being phased down and the use of which is anticipated to decrease in end-uses where safer alternatives are found acceptable under the SNAP program. EPA also notes that the modeling studies referenced generally assume a one-to-one substitution of HFO-1234yf for HFC-134a to be conservative. Any increase in TFA deposition due to this rule is expected to be less than the modeled increases in TFA from studies that found the levels of TFA in the environment remained, “too small to be a risk to the environment over the next few decades.” Use of HFO-1234yf and concerns about TFA in applications not addressed by this final rule are outside the scope of this rulemaking.

There are ongoing evaluations of the potential risks of TFA exposure. In 2020, the Environmental Effects Assessment Panel (EEAP) to the Montreal Protocol released an update⁹⁰ to its report on the environmental effects of stratospheric ozone depletion, UV radiation, and interactions with climate change, including the potential effects of TFA from ODS and their substitutes. That report noted that TFA “has a no-observed-effect-concentration (NOEC) for aquatic species, which is typically >10,000 µg/L,” while “analysis of 1187 samples of rainwater collected in eight locations across Germany in 2018–2019 showed median and a precipitation-weighted mean concentration of TFA of 0.210 µg/L and 0.335 µg/L, respectively,” and “another recent paper reported TFA . . . in precipitation in the low µg/L range across 28 cities in mainland China.” These studies and others led the EEAP to state, “Trifluoroacetic acid continues to be found in the environment, including in remote regions, although not at concentrations likely to have adverse toxicological consequences.”

In its 2021 Summary Update for Policymakers,⁹¹ the EEAP stated:

TFA likely has natural geochemical sources, is widely used in industry and research laboratories, and is a by-product of the synthesis and degradation of fluorinated

and perfluorinated compounds (PFCs) TFA has recently been found in precipitation, surface waters, and indoor dust in China . . . , although concentrations are below those considered toxic. No additional studies on the toxicity of TFA to organisms have been reported, but prior research has shown that this compound is not highly toxic to mammals and aquatic organisms, although some plants and algae may be sensitive At present, it is not possible to quantify the proportion of anthropogenic sources of TFA resulting from substances not falling under the purview of the Montreal Protocol, but available evidence indicates that this breakdown product is of minimal risk to human health. (p. 10; references in the text omitted here)

Most recently, in its 2022 Assessment Report,⁹² the EEAP stated:

TFA has a long environmental lifetime, accumulates in surface and ground waters, and has been found in blood, drinking water, beverages, dust, plants, and agricultural soils. However, it does not interact with biological molecules and, due to its high solubility in water, it does not bioaccumulate. It is unlikely to cause adverse effects in terrestrial and aquatic organisms. Continued monitoring and assessment are nevertheless advised due to uncertainties in the deposition of TFA and its potential effects on marine organisms (p.5)

The Montreal Protocol has led to the replacement of ODSs with fluorinated chemicals, some of which can undergo degradation in the atmosphere to give TFA in various yields. TFA is known to have a long environmental lifetime and accumulates in surface and ground waters. At present, there are large uncertainties associated with the concentrations of TFA in various environmental compartments in some regions, as well as the relative proportion of anthropogenic sources related to the Montreal Protocol, compared to the other anthropogenic and natural sources. There is some uncertainty in toxicity values because of the limited number of marine species tested. Current and predicted concentrations (to year 2100) of TFA in the oceans provide a large margin of exposure (thousand-fold) when compared to thresholds of toxicity. (p. 294)

EPA considers ecotoxicity as a criterion when evaluating alternatives under SNAP’s comparative risk framework, and the Agency has considered the potential impacts of TFA for the listings in this rule and in past actions that found HFO-1234yf acceptable in certain end-uses. For example, EPA studied the potential generation of TFA when first listing neat (*i.e.*, 100 percent, not in blends) HFO-1234yf as acceptable, subject to use

conditions, in motor vehicle air conditioning. The myriad studies EPA referenced all concluded that the additional TFA from HFO-1234yf did not pose a significant additional risk, even if it were assumed to be used as the only refrigerant in all refrigeration and air conditioning equipment (76 FR 17492–17493, March 29, 2011). The Agency intends to continue its approach to evaluating the potential risks from TFA in future SNAP regulations.

With regard to the commenter’s stance that safer low-GWP substitutes than HFO-1234yf currently exist for these end-uses, EPA disagrees. A number of alternatives can meet low-GWP and safety goals and EPA evaluates these potential alternatives through a holistic risk screen analysis with overall impact to human health and the environment in mind. The SNAP program’s aim is to expand the list of available substitutes that successfully meet conservative risk screen analysis thresholds so that industry may pull from a number of substances that can be used in equipment and that suit their functionality and needs. Risk screens, which can be viewed under this rule’s docket, were performed for industrial process refrigeration, cold storage warehouses, ice skating rinks, commercial ice machines, and retail food refrigeration. The findings of these risk screens conclude that HFO-1234yf does not pose a safety risk if used according to the safety standards required in this rule’s use conditions, such as UL 60335–2–89. HFO-1234yf has a GWP less than one, is excluded from the regulatory definition of VOC for the purpose of addressing the development of SIPs to attain and maintain the NAAQS and can be used without exceeding health-based exposure limits in the end-uses where it is being listed. Therefore, EPA does not consider the overall risk to human health and the environment due to HFO-1234yf in this final rule to be greater than for other available or potentially available substitutes for the same uses.

Comment: One commenter noted support for listing HFO-1234ze. The commenter stated that industry has made significant investments in research and development and has expanded capacity for production of HFOs, which are used as refrigerants or components in refrigerant blends.

Response: EPA acknowledges the commenter’s support for listing HFO-1234ze in this rulemaking. EPA has finalized acceptable listings for HFO-1234ze(E) as proposed.

Comment: One commenter requested that EPA clarify whether the mention of

⁹⁰ EEAP, 2020. “Environmental effects of stratospheric ozone depletion, UV radiation, and interactions with climate change: UNEP Environmental Effects Assessment Panel, Update 2020.” Photochemical & Photobiological Sciences <https://doi.org/10.1007/s43630-020-00001-x>. Available online at: https://engineering.case.edu/centers/sdle/sites/engineering.case.edu.centers.sdle/files/neale_et_al.-2021_-_environmental_effects_of_stratospheric_ozone_deple.pdf.

⁹¹ EEAP, 2021. “Summary Update 2021 for Policymakers” UNEP Environmental Effects Assessment Panel. Available online at https://ozone.unep.org/sites/default/files/assessment_panels/EEAP-summary-update-2021-for-policymakers.pdf.

⁹² EEAP, 2023. 2022 Assessment Report of Stratospheric Ozone Depletion, UV Radiation, and Interactions with Climate Change. UNEP, Environmental Effects Assessment Panel, May, 2023. Available online at: <https://ozone.unep.org/system/files/documents/EEAP-2022-Assessment-Report-May2023.pdf>.

R-424A on page 33731 of the Proposed Rule should have read R-454A.

Response: EPA agrees and clarifies that the mention of R-424A should have instead read R-454A. We have updated this language in this preamble.

Comment: Two commenters expressed support for listing R-455A. They urged swift action by EPA to approve this substitute. One commenter added that R-455A will provide industry with additional options to assist in their transition away from higher-GWP products and will help users achieve a GWP limit of 150 for certain commercial refrigeration applications.

Response: EPA acknowledges the commenters' support for listing R-455A in this rulemaking. EPA is finalizing acceptable listing decisions for R-455A as proposed, including certain commercial refrigeration applications.

Comment: Seven commenters noted related aspects of the current rulemaking to rulemakings under the AIM Act. Three of these commenters explicitly mentioned this SNAP rulemaking as an opportunity to adopt lower-GWP refrigerants in line with the objectives of the Technology Transitions Rule. The three commenters supported EPA listing such additional low-GWP refrigerants.

One commenter noted that they particularly support certain charge size limits in some of the approvals, which will help EPA meet its goals under the proposed Technology Transition rule.

One commenter encouraged EPA to approve refrigerants on a priority basis for end-uses capable of complying with the HFC restrictions in the Technology Transitions Rule. The commenter stated that this will bring about a practical phase down of HFCs in these applications that are critical to health and human comfort.

Response: EPA plans to continue to review substitutes consistent with the SNAP program criteria, including atmospheric impacts such as climate impacts. EPA agrees with commenters that the alternatives addressed in this SNAP rulemaking will provide additional lower-GWP options to comply with the HFC restrictions in the Technology Transition regulations.

Comment: One commenter noted concerns related to a January 1, 2025, deadline under EPA's regulations implementing the AIM Act for transitioning to new lower-GWP refrigerants. This commenter stated that it is not possible to change hundreds of designs, test, and acquire UL approvals in that time period. The commenter mentioned that if suppliers cannot provide the equipment needed for this

transition it would have detrimental business consequences. The commenter added that it is difficult to find qualified engineers to develop these projects; failure to extend deadlines could potentially cause many small refrigeration companies to go out of business.

Response: Comments related to EPA's regulations under the AIM Act are outside the scope of this rulemaking.

Comment: A commenter opposed the use of R-454A (GWP 239) or any other refrigerant with a GWP greater than 150 in self-contained equipment that exceeds the 150 GWP limit proposed under the Technology Transitions Rule.

Response: To the extent that this comment relates to the Technology Transitions Rule, EPA notes that it is outside the scope of this rulemaking. To the extent the commenter is referring to self-contained commercial ice machines, see the response in Section II.C.6 of the preamble. If the commenter is referring to other self-contained equipment in addition to self-contained commercial ice machines, EPA notes that we did not propose to list, and are not listing, any refrigerants with a GWP greater than 150 in retail food refrigeration—stand-alone units or retail food refrigeration—refrigerated food processing and dispensing equipment.

Comment: Three commenters referenced refrigerants or end-uses that were not part of the proposal. Two commenters referenced standards and requirements related to residential and light commercial air conditioning and heat pumps. One of these commenters suggested that rather than designating a specific numerical charge limit for R-290 in the sector, the final rule should refer more generally to the maximum charge size as allowed in UL 484 or UL 60335-2-40, which would provide a mechanism for automatic adjustment in response to new information. Another commenter suggested harmonization of U.S. industry safety standards under UL 60335-2-40 and the ASHRAE 15 standard with the most recent edition of the IEC 60335-2-40 standard. This commenter stated that aligning to the IEC standard would accelerate the transition away from climate polluting substances in many air conditioning and heat-pump systems, such as R-410A (GWP >2,000), to sustainable alternatives, such as R-290 (GWP three). This commenter felt that adopting the IEC standard would usher in uptake of low-GWP refrigerants in the air conditioning and heat pump sectors, as evidenced by the swift transition to R-600a (GWP three) in the refrigerator market following a 2017 update to the UL standard. One commenter asked

EPA to consider listing substitutes that are not part of the proposal. They asked for EPA to consider listing HCFO-1233zd(E) and R-471A for use in commercial refrigeration generally to assist in the transition away from higher-GWP refrigerants.

Response: EPA acknowledges these comments expressing support for hydrocarbons and other lower-GWP refrigerants in AC equipment. EPA did not propose listings for refrigerants in AC, and therefore, these comments are outside the scope of this final rule. The Agency may consider proposing additional listings, including listings for lower-GWP refrigerants in residential and light commercial air conditioning and heat pumps, in future rulemakings and may also consider updating use conditions for existing hydrocarbon listings. The Agency also did not propose to list R-471A and HCFO-1233zd(E) for use in other end-uses; therefore, these comments are beyond the scope of this rulemaking. Every substitute listed under the SNAP program undergoes a comparative risk analysis for submitted end-uses; the substitutes suggested by commenters did not undergo risk screen review. To list the greatest number of low-GWP refrigerant options for industry to use as is possible, the commenters' suggested substitutes and end-uses will not be included within the scope of this rulemaking. EPA also notes that in other listing documents, we have listed both R-471A and HCFO-1233zd(E) as acceptable in some end-uses, e.g., listing of R-471A as acceptable in new equipment for retail food refrigeration, IPR, and cold storage warehouses (88 FR 61977, September 8, 2023).

Comment: One commenter noted that EPA identifies hydrocarbons and R-717 as secondary refrigerants and asserted that these would not be used as secondary fluids.

Response: EPA agrees with the commenter that hydrocarbons and R-717 would not typically be used as a secondary fluid that is pumped throughout a store to cases in a cascade system. Rather, hydrocarbons and R-717 could be used as the primary refrigerant used to cool a secondary fluid in a cascade system or secondary loop system. In the final rule, EPA is revising the statement to read, "Examples of secondary fluids include water, brine, propylene glycol, air, and carbon dioxide (CO₂)."

III. Statutory and Executive Order Reviews

Additional information about these statutes and Executive Orders can be

found at <https://www.epa.gov/laws-regulations/laws-and-executive-orders>.

A. Executive Order 12866: Regulatory Planning and Review and Executive Order 14094: Modernizing Regulatory Review

This action is not a significant regulatory action as defined in Executive Order 12866, as amended by Executive Order 14094 and was therefore not submitted to the Office of Management and Budget (OMB) for review.

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 activities contained in the existing regulations and has assigned OMB control number 2060-0226. The approved Information Collection Request includes five types of respondent reporting and recordkeeping activities pursuant to SNAP regulations: submission of a SNAP petition, filing a Toxic Substances Control Act (TSCA)/SNAP Addendum, notification for test marketing activity, recordkeeping for substitutes acceptable, subject to use restrictions, and recordkeeping for small volume uses. This rule contains no new requirements for reporting or recordkeeping.

C. Regulatory Flexibility Act (RFA)

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. In making this determination, EPA concludes that the impact of concern for this rule is any significant adverse economic impact on small entities and that the agency is certifying that this rule will not have a significant economic impact on a substantial number of small entities because the rule has no net burden on the small entities subject to the rule. This action lists additional options under SNAP for using HFC-32, HFO-1234yf, HFO-1234ze(E), R-290, R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A in the specified end-uses, but does not mandate such use. Because equipment for HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A is not manufactured yet in the U.S. for retail food refrigeration equipment, commercial ice machines, IPR, cold storage warehouses, and ice skating rinks, no change in business practice is

required to meet the use conditions, resulting in no adverse impact compared with the absence of this rule. The new use conditions for R-290 in stand-alone units and self-contained commercial ice machines were requested by industry and are consistent with the most recent, updated industry standard. These allow for greater consistency in business practices for different types of equipment using the same refrigerant, as well as provide greater flexibility in designing and manufacturing equipment. Equipment for R-290 already manufactured prior to the effective date of this rule will not be required to be changed. Stand-alone units and self-contained commercial ice machines using R-290 have been subject to similar use conditions, and thus the updated requirements result in no adverse impact compared with the absence of this rule. Thus, the rule does not impose new costs on small entities. We have therefore concluded that this action will have no net regulatory burden for all directly regulated small entities.

D. Unfunded Mandates Reform Act (UMRA)

This action does not contain any unfunded mandate of \$100 million (adjusted annually for inflation) or more (in 1995 dollars) 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.

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 periodically updates Tribal officials on air regulations through the monthly meetings of the National Tribal Air Association and will share information on this rulemaking through this and other fora.

G. Executive Order 13045: Protection of Children From Environmental Health and Safety Risks

Executive Order 13045 (62 FR 19885, April 23, 1997) directs Federal agencies to include an evaluation of the health and safety effects of the planned regulation on children in Federal health and safety standards and explain why the regulation is preferable to potentially effective and reasonably feasible alternatives. This action is not subject to Executive Order 13045 because it is not a significant regulatory action under section 3(f)(1) of Executive Order 12866, and because the EPA does not believe the environmental health or safety risks addressed by this action present a disproportionate risk to children. While EPA has not conducted a separate analysis of risks to infants and children associated with this rule, the rule contains use conditions that reduce exposure risks to the general population, with the reduction of exposure being most important to the most sensitive individuals. This action's health and risk assessments are contained in the comparisons of toxicity for the various substitutes, as well as in the risk screens for the substitutes that are listed in this rule. The risk screens are in the docket for this rulemaking. However, EPA's *Policy on Children's Health* applies to this action.

H. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

This action is not subject to Executive Order 13211, because it is not a significant regulatory action under Executive Order 12866.

I. National Technology Transfer and Advancement Act and Incorporation by Reference

This action involves technical standards. EPA has decided to use and incorporate by reference UL 60335-2-89, which establishes requirements for the evaluation of commercial refrigeration equipment and commercial ice machines and safe use of flammable refrigerants, among other things. This standard is discussed in greater detail in section II.H.1 of this preamble.

UL 60335–2–89, “Standard for Safety for Household And Similar Electrical Appliances—Safety—Part 2–89: Particular Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor Compressor,” 2nd edition, October 27, 2021, is available at: https://www.shopulstandards.com/ProductDetail.aspx?productId=UL60335-2-89_2_S_20211027, and may be purchased by mail at: COMM 2000, 151 Eastern Avenue, Bensenville, IL 60106; email: orders@shopulstandards.com; Telephone: 1–888–853–3503 in the U.S. or Canada (other countries dial 1–415–352–2178); internet address: <https://ulstandards.ul.com> or <https://www.shopulstandards.com>. The cost of the 2021 standard UL 60335–2–89 is \$519 for an electronic copy and \$649 for a hard copy. UL also offers a subscription service to the Standards Certification Customer Library 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 necessary for those selling, installing, and servicing the equipment. Therefore, EPA concludes that the UL standard being incorporated by reference is reasonably available.

EPA is also incorporating by reference Chapter 2.2, Flammable Gasses, and Annex 1, Classification and Labelling Summary Tables, of ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition, copyright 2021, which define the GHS diamond symbol (pictogram) for hazard category 1 flammable gasses, in the use conditions for hazard labeling of commercial and industrial refrigeration equipment. Printed versions and electronic editable versions are available for sale at the United Nations Publications section at: <https://shop.un.org/books/global-harmon-syst-class-9-92280> and may be purchased by mail at: United Nations Publications Customer Service, P.O. Box 960, Herndon, VA 20172; by email at order@un.org; and by telephone at 1–703–661–1571. The cost of the 9th edition of the GHS is \$75.00 for an electronic copy or \$150.00 for a printed hard copy. A copyright permission request is not required for the use of up to 2 graphs, charges, tables, and figures. The cost of obtaining this standard is not a significant financial burden for equipment manufacturers or for those selling, installing, and servicing the equipment. Therefore, EPA concludes

that the material incorporated by reference is reasonably available.

EPA is also incorporating by reference ANSI/ASHRAE Standard 15–2022, Safety Standard for Refrigeration Systems, copyright 2022, in the use conditions for refrigerants listed for use in larger refrigeration equipment (see summary in Section II.A.4 of the preamble) and ANSI/ASHRAE Standard 34–2022, Designation and Safety Classification of Refrigerants, copyright 2022, in the use conditions for labeling refrigeration equipment with the safety classification of the refrigerant used (see summary in Section II.A.2 of the preamble). These standards are available at <https://www.ashrae.org/technical-resources/bookstore/ashrae-refrigeration-resources> and may be purchased by mail at: 180 Technology Parkway NW, Peachtree Corners, Georgia 30092; by telephone: 1–800–527–4723 in the U.S. or Canada. ASHRAE 15–2022 and ASHRAE 34–2022 are available as a bundle costing \$169.00 for an electronic copy or hard copy. The cost of obtaining the standard is not a significant financial burden for equipment manufacturers or for those selling, installing, and servicing the equipment. Therefore, EPA concludes that the ASHRAE standards incorporated by reference are reasonably available.

EPA is also incorporating by reference ANSI/ASHRAE Addendum a to ANSI/ASHRAE Standard 34–2022, Designation and Safety Classification of Refrigerants, ANSI-/ASHRAE-approved December 20, 2022. This standard is available at <https://www.ashrae.org/technical-resources/standards-and-guidelines/standards-addenda>. Addenda for ASHRAE standards are available online in PDF format for free. Addendum a adds burning velocity data, updates some LFL values, and corrects several calculation errors that were identified, particularly for RCL values driven by flammability versus toxicity.

The following standards are already approved for incorporation by reference at the locations where they appear in the amendatory text: UL 471, UL 541, UL 484, UL 60335–2–24, and UL 60335–2–40.

J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations and Executive Order 14096: Revitalizing Our Nation's Commitment to Environmental Justice for All

The EPA believes that the human health or environmental conditions that exist prior to this action result in or

have the potential to result in disproportionate and adverse human health or environmental effects on communities with environmental justice concerns. EPA's analysis indicates that other environmental impacts and human health impacts of listing HFC–32, HFO–1234yf, HFO–1234ze(E), R–290, R–454A, R–454B, R–454C, R–455A, R–457A, and R–516A in the end-uses addressed in this action are comparable to or less than those of other substitutes that are listed as acceptable for the same end-use. For example, these alternative refrigerants would likely have lower climate impacts because of their lower GWPs compared to other available substitutes for the same uses.

The EPA believes that it is not practicable to assess whether this action is likely to result in new disproportionate and adverse effects on communities with environmental justice concerns. Because adoption of the new substitutes listed in this rule is voluntary, the Agency is unable to quantify when, where, and how much of the listed substitutes will be produced and used. Thus, EPA cannot determine the extent to which this rule will exacerbate or reduce existing disproportionate adverse effects on communities of color and low-income people as specified in Executive Order 12898 (59 FR 7629, February 16, 1994).

However, the listings for HFC–32, HFO–1234yf, HFO–1234ze(E), R–290, R–454A, R–454B, R–454C, R–455A, R–457A, and R–516A in the end-uses addressed in this action provide additional lower-GWP or comparable alternatives in their respective end-uses. By providing lower-GWP or comparable alternatives for these end-uses, this rule is anticipated to reduce the use and eventual emissions of potent greenhouse gases in these end-uses, which could help to reduce the effects of climate change, including the existing disproportionate public health and welfare effects on communities with environmental justice concerns. The Agency will continue to evaluate the impacts of this program on communities with environmental justice concerns and consider further action, as appropriate.

The EPA additionally identified and addressed environmental justice concerns by conducting and sharing risk screens and air quality modeling to provide information to the public about the listed refrigerants contained in this rulemaking. The information supporting this Executive Order review is contained in the comparison of health and environmental risks for HFC–32, HFO–1234yf, HFO–1234ze(E), R–290, R–454A, R–454B, R–454C, R–455A, R–

457A, and R-516A as well as in the risk screens that are available in the docket for this rulemaking.

K. Congressional Review Act (CRA)

This action is subject to the CRA, and the EPA will submit a rule report to each House of the Congress and to the Comptroller General of the United States. This action is not a “major rule” as defined by 5 U.S.C. 804(2).

IV. References

Unless specified otherwise, all documents are available electronically at *regulations.gov*, docket number EPA-HQ-OAR-2023-0043.

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List of Subjects in 40 CFR Part 82

Environmental protection, Administrative practice and procedure, Air pollution control, Incorporation by reference, Stratospheric ozone layer.

Michael S. Regan,
Administrator.

For the reasons stated in the preamble, EPA amends 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 revising paragraph (a)(1)(viii) to read as follows:

§ 82.154 Prohibitions.

(a) * * *

(1) * * *

(viii) Propane (R-290) in retail food refrigerators and freezers—stand-alone units; household refrigerators, freezers, and combination refrigerators and freezers; self-contained room air conditioners for residential and light commercial air-conditioning and heat pumps; vending machines; self-contained commercial ice machines, very low temperature refrigeration

equipment, and water coolers; and effective July 15, 2024, retail food refrigeration—refrigerated food processing and dispensing equipment;
 * * * * *

Subpart G—Significant New Alternatives Policy Program

■ 3. Amend appendix R to subpart G of part 82 by:

■ a. Revising the heading; and

■ b. Revising the table titled “Substitutes That Are Acceptable Subject to Use Conditions.”

The revisions read as follows:

Appendix R to Subpart G of Part 82—Substitutes Subject to Use Restrictions Listed in the December 20, 2011, Final Rule, Effective February 21, 2012, in the April 10, 2015, Final Rule, Effective May 11, 2015, in the April 28, 2023, Final Rule, Effective May 30, 2023, and in the June 13, 2024, Final Rule, Effective July 15, 2024

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS

| End-use | Substitute | Decision | Use conditions | Further information |
|--|--|---------------------------------------|--|---|
| 1. Household refrigerators, freezers, and combination refrigerators and freezers (New equipment only). | Isobutane (R-600a), Propane (R-290), R-441A. | Acceptable subject to use conditions. | As of September 7, 2018: These refrigerants may be used only in new equipment designed specifically and clearly identified for the refrigerant (<i>i.e.</i> , none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for a different refrigerant). These refrigerants may be used only in a refrigerator or freezer, or combination refrigerator and freezer, that meets requirements listed in UL 60335–2–24. ^{1 2 6} | Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.94 (ventilation), 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 re-entry should occur only after the space has been properly ventilated. 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 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. 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 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. |

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---|--|---------------------------------------|---|--|
| 2. Retail Food Refrigeration—stand-alone units only (New equipment only) manufactured on or after February 21, 2012, and up to but not including 7/15/2024. | Isobutane (R-600a) Propane (R-290) R-441A. | Acceptable subject to use conditions. | <p>These refrigerants may be used only in new equipment specifically designed and clearly identified for the refrigerants (<i>i.e.</i>, none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>These substitutes may only be used in equipment that meets requirements in Supplement SB to UL 471.^{1,2,3} In cases where this listing 2 includes requirements more stringent than those of UL 471, the appliance must meet the requirements of this listing 2 in place of the requirements in the UL Standard.</p> <p>The charge size for the retail food refrigerator or freezer shall not exceed 150 grams (5.3 ounces) in each circuit.</p> <p>As provided in clauses SB6.1.2 to SB6.1.5 of UL 471,^{1,2,3} the following markings shall be attached at the locations provided and shall be permanent:</p> <p>(a) On or near any evaporators that can be contacted by the consumer: “DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing.”</p> <p>(b) Near the machine compartment: “DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”</p> <p>(c) 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.”</p> <p>(d) On the exterior of the refrigerator: “CAUTION—Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(e) Near any and all exposed refrigerant tubing: “CAUTION—Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used.”</p> <p>All of these markings shall be in letters no less than 6.4 mm (1/4 inch) high.</p> <p>The refrigerator or freezer must have red, Pantone® Matching System #185 or RAL 3020 marked pipes, hoses, and other devices through which the refrigerant is serviced, typically known as the service port, to indicate the use of a flammable refrigerant. This color must be present at all service ports and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (<i>e.g.</i>, process tubes). The color mark must extend at least 2.5 centimeters (1 inch) from the compressor and must be replaced if removed.</p> | <p>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).</p> <p>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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling propane. Special care should be taken to avoid contact with the skin since propane, like many refrigerants, can cause freeze burns on the skin. A Class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on refrigerators and freezers with propane.</p> <p>Recovery equipment designed for flammable refrigerants should be used.</p> <p>Only technicians specifically trained in handling flammable refrigerants should service refrigerators and freezers containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>If a service port is added then stand-alone retail food refrigeration units 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>i.e.</i>, 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.</p> |

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|--|---|--|--|--|
| <p>3. Retail Food Refrigeration—stand-alone units only (New equipment only) manufactured from 7/15/2024, through September 29, 2024, or equipment manufactured on or after September 30, 2024, except for equipment manufactured on or after September 30, 2024, that remains unchanged, other than cosmetic changes, from an earlier model or design that was already certified to the UL 471^{1 2 3} standard before September 30, 2024.</p> | <p>Isobutane (R-600a) Propane (R-290) R-441A.</p> | <p>Acceptable subject to use conditions.</p> | <p>These substitutes may only be used in equipment that meets requirements of either:</p> <ol style="list-style-type: none"> 1. Supplement SB to UL 471^{1 2 3} and listing 2 of this table or 2. ASHRAE 15-2022,^{1 9 12} UL 60335-2-89,^{1 2 8} and listing 4 of this table. | |
| <p>4. Retail Food Refrigeration—stand-alone units only (New equipment only) manufactured on or after September 30, 2024, except for equipment manufactured on or after September 30, 2024, that remains unchanged, other than cosmetic changes, from an earlier model or design that was already certified to the UL 471^{1 2 3} standard before September 30, 2024.</p> | <p>Isobutane (R-600a) Propane (R-290) R-441A.</p> | <p>Acceptable subject to use conditions.</p> | <p>This refrigerant may be used only in new equipment specifically designed and clearly identified for the refrigerant (<i>i.e.</i>, this substitute may not be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>This refrigerant may be used in new stand-alone units if and only if such equipment meets all requirements listed in ASHRAE 15-2022.^{1 9 12} In cases where this listing 4 includes requirements different than those of ASHRAE 15-2022, the appliance would need to meet the requirements of this listing in addition to the requirements in ASHRAE 15-2022.</p> <p>This refrigerant may only be used in stand-alone units that meet all requirements in UL 60335-2-89^{1 2 8} except as provided otherwise in UL 60335-2-89, in ASHRAE 15-2022,^{1 9 12} or in this listing 4. In cases where this listing includes requirements more stringent than those of UL 60335-2-89, the appliance must meet the requirements of this listing 4 in addition to requirements in UL 60335-2-89. Where similar requirements of ASHRAE 15-2022 and UL 60335-2-89 differ, the more stringent or conservative condition shall apply unless superseded by this listing 4.</p> <p>The following markings must be attached at the locations provided and must be permanent:</p> | <p>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).</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing flammable 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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin.</p> <p>A Class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools</p> |

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---------|------------|----------|--|--|
| | | | <p>(a) On the outside of the equipment: “DANGER—Risk of Fire Or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing”</p> <p>(b) On the outside of the equipment: “WARNING—Risk of Fire Or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(c) On the inside of the equipment near the compressor: “DANGER—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”</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: “WARNING—Risk of Fire Due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations.”</p> <p>a. If the equipment is delivered packaged, this label shall be applied on the packaging.</p> <p>b. If the equipment is not delivered packaged, this label shall be applied on the outside of the equipment near the control panel or nameplate.</p> <p>(e) On the indoor unit near the nameplate:</p> <p>a. At the top of the marking: “Minimum Installation height, X m (W ft).” This marking is only required if required by UL 60335–2–89. The terms “X” and “W” shall be replaced by the numeric height as calculated per UL 60335–2–89. Note that the formatting here is slightly different than UL 60335–2–89; specifically, the height in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p>b. Immediately below a or at the top of the marking if a is not required: “Minimum room area (operating or storage), Y m² (Z ft²).” The terms “Y” and “Z” shall be replaced by the numeric area as calculated per UL 60335–2–89. Note that the formatting here is slightly different than UL 60335–2–89; specifically, the area in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, on the outside of the product: “WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition.”</p> <p>(g) For fixed equipment that is ducted, near the nameplate: “WARNING—Risk Of Fire Or Explosion—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.”</p> <p>(h) All of these markings must be in letters no less than 6.4 mm (1/4 inch) high.</p> <p>The equipment must have red Pantone® Matching System #185 or RAL 3020 marked service ports, 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 (25mm) in both directions from such locations and shall be replaced if removed.</p> | <p>when working on equipment containing flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Any person commissioning, maintaining, repairing, decommissioning, and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex 101.DVT of UL 60355–2–89, 2nd edition.^{1 2 8}</p> <p>Department of Transportation requirements for transport of flammable gases must be followed.</p> <p>Flammable refrigerants being recovered or otherwise disposed of from stand-alone units are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270).</p> |

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|--|----------------------------|--|---|---|
| <p>5. Very low temperature refrigeration. Non-mechanical heat transfer (New equipment only).</p> | <p>Ethane (R-170)</p> | <p>Acceptable subject to use conditions.</p> | <p>In addition to or instead of the markings described in Clause 7.6DV D1 of UL 60335-2-89,^{1 2 3} the equipment may display the GHS warning symbol for hazard category 1 flammable gases (black flame on a white background in a diamond with equal length sides with a red border), as defined in Chapter 2.2, Flammable Gases, and Annex 1, Classification and Labelling Summary Tables, of ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition^{1 13 14} on the following three locations:</p> <ul style="list-style-type: none"> • Outside of the equipment (label (a)); • on the appliance packaging for a factory-charged unit or adjacent to the control panel or nameplate of a unit charged in place (label (d)); and • in a location visible when accessing a service port and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes) (service label). <p>The perpendicular height of the diamond containing the GHS warning symbol for hazard category 1 flammable gases shall be at least 15 mm (5/16 in). In addition, next to the GHS warning symbol for hazard category 1 flammable gases must be text of the refrigerant safety class of the refrigerant according to ASHRAE 34-2022,^{1 9 10 11} in letters at least one-third the height of the diamond symbol.</p> <p>This refrigerant may be used only in new equipment specifically designed and clearly identified for the refrigerant (i.e., the substitute may not be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>This refrigerant may only be used in equipment that meets requirements in Supplement SB to UL 471.^{1 2 3} In cases where this listing 5 of this table includes requirements more stringent than those of UL 471, the appliance must meet the requirements of listing 5 of this table in place of the requirements in UL 471.</p> <p>The charge size for the equipment must not exceed 150 g (5.29 oz) in each circuit.</p> <p>As provided in clauses SB6.1.2 to SB6.1.5 of UL 471,^{1 2 3} the following markings must be attached at the locations provided and must be permanent:</p> | <p>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).</p> <p>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.</p> <p>Technicians and equipment manufacturers</p> |

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---|--|---------------------------------------|---|--|
| 6. Vending machines (New equipment only). | Isobutane (R-600a), Propane (R-290), R-441A. | Acceptable subject to use conditions. | <p>(a) On or near any evaporators that can be contacted by the consumer: "DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing."</p> <p>(b) Near the machine compartment: "DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing."</p> <p>(c) 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."</p> <p>(d) On the exterior of the refrigerator: "CAUTION—Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used."</p> <p>(e) Near any and all exposed refrigerant tubing: "CAUTION—Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used."</p> <p>All of these markings must be in letters no less than 6.4 mm (1/4 inch) high.</p> <p>The refrigeration equipment must have red, Pantone® Matching System #185 or RAL 3020 marked pipes, hoses, and other devices through which the refrigerant is serviced, typically known as the service port, to indicate the use of a flammable refrigerant. This color must be present at all service ports and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes). The color mark must extend at least 2.5 centimeters (1 inch) from the compressor and must be replaced if removed.</p> <p>These refrigerants may be used only in new equipment specifically designed and clearly identified for the refrigerants (i.e., none of these substitutes may be used as a conversion or "retrofit" refrigerant for existing equipment designed for other refrigerants). Detaching and replacing the old refrigeration circuit from the outer casing of the equipment with a new one containing a new evaporator, condenser, and refrigerant tubing within the old casing is considered "new" equipment and not a retrofit of the old, existing equipment.</p> <p>These substitutes may only be used in equipment that meets requirements in Supplement SA to UL 541.^{1,2,5} In cases where this listing 6 of this table includes requirements more stringent than those of UL 541, the appliance must meet the requirements of this listing 6 of this table in place of the requirements in UL 541. The charge size for vending machines must not exceed 150 g (5.29 oz) in each circuit.</p> <p>As provided in clauses SA6.1.2 to SA6.1.5 of UL 541,^{1,2,5} the following markings must be attached at the locations provided and must be permanent:</p> | <p>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.</p> <p>A Class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants.</p> <p>Any refrigerant releases should be in a well-ventilated area, such as outside of a building.</p> <p>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. Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>If a service port is added then refrigeration equipment using this refrigerant 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.</p> <p>An example of non-mechanical heat transfer using this refrigerant would be use in a secondary loop of a thermosiphon.</p> <p>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).</p> <p>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.</p> <p>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.</p> |

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---|--------------------------|---------------------------------------|--|---|
| 7. Residential and light-commercial air conditioning and heat pumps—self-contained room air conditioners only (New equipment only). | Propane (R-290), R-441A. | Acceptable subject to use conditions. | <p>(a) On or near any evaporators that can be contacted by the consumer: “DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing.”</p> <p>(b) Near the machine compartment: “DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”</p> <p>(c) 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.”</p> <p>(d) On the exterior of the refrigerator: “CAUTION—Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(e) Near any and all exposed refrigerant tubing: “CAUTION—Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used.”</p> <p>All of these markings must be in letters no less than 6.4 mm (¼ inch) high.</p> <p>The refrigeration equipment must have red, Pantone® Matching System #185 or RAL 3020 marked pipes, hoses, and other devices through which the refrigerant is serviced, typically known as the service port, to indicate the use of a flammable refrigerant. This color must be present at all service ports and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (<i>e.g.</i>, process tubes). The color mark must extend at least 2.5 centimeters (1 inch) from the compressor and must be replaced if removed.</p> <p>These refrigerants may be used only in new equipment specifically designed and clearly identified for the refrigerants (<i>i.e.</i>, none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>These refrigerants may only be used in equipment that meets requirements in Supplement SA and Appendices B through F of UL 484.^{1 2 4} In cases where listing 7 of this table includes requirements more stringent than those of UL 484, the appliance must meet the requirements of this listing 7 of this table in place of the requirements in UL 484.</p> <p>The charge size for the entire air conditioner must not exceed the maximum refrigerant mass determined according to Appendix F of UL 484 for the room size where the air conditioner is used. The charge size for these three refrigerants must in no case exceed 1,000 g (35.3 oz or 2.21 pounds) of propane or 1,000 g (35.3 oz or 2.21 pounds) of R-441A. For portable air conditioners, the charge size must in no case exceed 300 g (10.6 oz or 0.66 pounds) of propane or 330 g (11.6 oz or 0.72 pounds) of R-441A. The manufacturer must design a charge size for the entire air conditioner that does not exceed the amount specified for the unit’s cooling capacity, as specified in table A, B, C, D, or E of this appendix R.</p> | <p>A Class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on refrigeration equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants.</p> <p>Any refrigerant releases should be in a well-ventilated area, such as outside of a building.</p> <p>Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing these refrigerants. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>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).</p> <p>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.</p> <p>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.</p> <p>A Class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> |

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---|---------------------|--|--|---|
| <p>8. Residential and light-commercial air conditioning and heat pumps—self-contained room air conditioners only (New equipment only) manufactured from May 10, 2015, and up to but not including May 30, 2023.</p> | <p>HFC-32</p> | <p>Acceptable subject to use conditions.</p> | <p>As provided in clauses SA6.1.2 to SA6.1.5 of UL 484,^{1 2 4} the following markings must be attached at the locations provided and must be permanent:</p> <p>(a) On the outside of the air conditioner: “DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”</p> <p>(b) On the outside of the air conditioner: “CAUTION—Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(c) On the inside of the air conditioner near the compressor: “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.”</p> <p>(d) On the outside of each portable air conditioner: “WARNING: Appliance shall be installed, operated and stored in a room with a floor area larger the “X” m² (Y ft²).” The value “X” on the label must be determined using the minimum room size in m² calculated using Appendix F of UL 484. For R-441A, use a lower flammability limit of 0.041 kg/m³ in calculations in Appendix F of UL 484.</p> <p>All of these markings must be in letters no less than 6.4 mm (¼ inch) high.</p> <p>The air conditioning equipment must have red, Pantone® Matching System #185 or RAL 3020 marked pipes, hoses, and other devices through which the refrigerant is serviced, typically known as the service port, to indicate the use of a flammable refrigerant. This color must be present at all service ports and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes). The color mark must extend at least 2.5 centimeters (1 inch) from the compressor and must be replaced if removed.</p> <p>This refrigerant may be used only in new equipment specifically designed and clearly identified for the refrigerant (i.e., this substitute may not be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>This refrigerant may only be used in equipment that meets all requirements in Supplement SA and Appendices B through F of UL 484.^{1 2 4} In cases where this listing 8 of this table includes requirements more stringent than those of UL 484, the appliance must meet the requirements of listing 8 of this table in place of the requirements in UL 484.</p> <p>The charge size for the entire air conditioner must not exceed the maximum refrigerant mass determined according to Appendix F of UL 484 for the room size where the air conditioner is used. The manufacturer must design a charge size for the entire air conditioner that does not exceed the amount specified for the unit’s cooling capacity, as specified in table A, B, C, D, or E of this appendix.</p> <p>For equipment following this listing 8, and as provided in clauses SA6.1.2 to SA6.1.5 of UL 484,^{1 2 4} the following markings must be attached at the locations provided and must be permanent:</p> | <p>Any recovery equipment used should be designed for flammable refrigerants.</p> <p>Any refrigerant releases should be in a well-ventilated area, such as outside of a building.</p> <p>Only technicians specifically trained in handling flammable refrigerants should service air conditioning equipment containing these refrigerants. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>If a service port is added then air conditioning equipment using this refrigerant 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.</p> <p>Examples of air conditioning equipment in this category include window air conditioning units, portable room air conditioners, and packaged terminal air conditioners and heat pumps.</p> <p>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).</p> <p>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.</p> <p>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.</p> <p>A Class B dry powder type fire extinguisher should be kept nearby.</p> |

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---|---------------------|--|--|--|
| <p>9. Residential and light-commercial air conditioning and heat pumps—self-contained room air conditioners only (New equipment only) manufactured from May 30, 2023 through January 1, 2024.</p> | <p>HFC-32</p> | <p>Acceptable subject to use conditions.</p> | <p>(a) On the outside of the air conditioner: "DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing."</p> <p>(b) On the outside of the air conditioner: "CAUTION—Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used."</p> <p>(c) On the inside of the air conditioner near the compressor: "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."</p> <p>(d) On the outside of each portable air conditioner: "WARNING: Appliance shall be installed, operated and stored in a room with a floor area larger the "X" m² (Y ft²)." The value "X" on the label must be determined using the minimum room size in m² calculated using Appendix F of UL 484.</p> <p>All of these markings must be in letters no less than 6.4 mm (1/4 inch) high.</p> <p>The air conditioning equipment must have red, Pantone® Matching System (PMS) #185 marked pipes, hoses, and other devices through which the refrigerant is serviced, typically known as the service port, to indicate the use of a flammable refrigerant. This color must be present at all service ports and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes). The color mark must extend at least 2.5 centimeters (1 inch) from the compressor and must be replaced if removed.</p> <p>This refrigerant may only be used in equipment that meets all requirements in either:</p> <p>(1) Supplement SA and Appendices B through F of UL 484¹²⁴ and listing 8 of this table, or</p> <p>(2) UL 60335-2-40¹²⁷ and listing 10 of this table.</p> | <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants.</p> <p>Any refrigerant releases should be in a well-ventilated area, such as outside of a building.</p> <p>Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing these refrigerants. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>If a service port is added then air conditioning equipment using this refrigerant 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.</p> <p>Air conditioning equipment in this category includes:</p> <ul style="list-style-type: none"> Window air conditioning units. Portable room air conditioners. Packaged terminal air conditioners and heat pumps. |

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---|---------------------|--|--|--|
| <p>10. Residential and light-commercial air conditioning and heat pumps—self-contained room air conditioners only. (New equipment only) manufactured on or after January 2, 2024.</p> | <p>HFC-32</p> | <p>Acceptable subject to use conditions.</p> | <p>This refrigerant may be used only in new equipment specifically designed and clearly identified for the refrigerant (<i>i.e.</i>, this substitute may not be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>This substitute may only be used in air conditioning equipment that meets all requirements in UL 60335–2–40^{1,2,7} and this listing 10 of this table.</p> <p>In cases where this listing 10 includes requirements more stringent than those of UL 60335–2–40, the appliance must meet the requirements of this listing 10 in place of the requirements in UL 60335–2–40.</p> <p>The following markings must be attached at the locations provided and must be permanent:</p> <p>(a) On the outside of the equipment: “WARNING—Risk of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”</p> <p>(b) On the outside of the equipment: “WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(c) On the inside of the equipment near the compressor: “WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner’s Guide Before Attempting to Service This Product. All Safety Precautions Must be Followed.”</p> | <p>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), and 1910.1000 (toxic and hazardous substances).</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing flammable 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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin.</p> <p>A class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants. Only technicians specifically trained in handling flam-</p> |

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---------|------------|----------|--|---|
| | | | <p>(d) For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: “WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations” a. If the equipment is delivered packaged, this label shall be applied on the packaging. b. If the equipment is not delivered packaged, this label shall be applied on the outside of the equipment near the control panel or nameplate.</p> <p>(e) On the equipment near the nameplate: a. At the top of the marking: “Minimum Installation height, X m (W ft).” This marking is only required if required by the UL 60335–2–40. The terms “X” and “W” shall be replaced by the numeric height as calculated per UL 60335–2–40. Note that the formatting here is slightly different than UL 60335–2–40; specifically, the height in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis. b. Immediately below marking (a) of this listing 8 or at the top of the marking if marking (a) is not required: “Minimum room area (operating or storage), Y m² (Z ft²).” The terms “Y” and “Z” shall be replaced by the numeric area as calculated per UL 60335–2–40. Note that the formatting here is slightly different than UL 60335–2–40; specifically, the area in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, on the outside of the product: “WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition.” (g) All of these markings must be in letters no less than 6.4 mm (¼ inch) high. The equipment must have red Pantone Matching System (PMS) #185 or RAL 3020 marked service ports, 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 (25mm) in both directions from such locations and shall be replaced if removed.</p> | <p>flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely. Room occupants should evacuate the space immediately following the accidental release of this refrigerant. Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex HH of UL 60335–2–40.^{2,7} CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration. Department of Transportation requirements for transport of flammable gases must be followed. Flammable refrigerants being recovered or otherwise disposed of from residential and light commercial air conditioning appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270).</p> |

¹ The Director of the Federal Register approves this incorporation by reference (5 U.S.C. 552(a) and 1 CFR part 51). You may inspect a copy at the U.S. EPA or at the National Archives and Records Administration (NARA). Contact the U.S. EPA at: EPA Docket Center, WJC West Building, Room 3334, 1301 Constitution Avenue NW, Washington, DC 20004, <https://www.epa.gov/dockets>, (202) 566–1742. For information on the availability of this material at NARA, visit <https://www.archives.gov/federal-register/cfr/ibr-locations> or email fr.inspection@nara.gov.

² You may obtain the UL material from: Underwriters Laboratories Inc. (UL) COMM 2000; 151 Eastern Avenue; Bensenville, IL 60106; phone: 1–888–853–3503 in the U.S. or Canada (other countries +1–415–352–2168); email: orders@shopulstandards.com; website: <https://ulstandards.ul.com> or www.shopulstandards.com.

³ UL 471. Commercial Refrigerators and Freezers. 10th edition. Supplement SB: Requirements for Refrigerators and Freezers Employing a Flammable Refrigerant in the Refrigerating System. November 24, 2010.

⁴ UL 484. Room Air Conditioners. 8th edition. Supplement SA: Requirements for Room Air Conditioners Employing a Flammable Refrigerant in the Refrigerating System and Appendices B through F. December 21, 2007, with changes through August 3, 2012.

⁵ UL 541. Refrigerated Vending Machines. 7th edition. Supplement SA: Requirements for Refrigerated Venders Employing a Flammable Refrigerant in the Refrigerating System. December 30, 2011.

⁶ UL 60335–2–24. Standard for Safety: Requirements for Household and Similar Electrical Appliances.—Safety—Part 2–24: Particular Requirements for Refrigerating Appliances, Ice-Cream Appliances and Ice-Makers, 2nd edition, dated April 28, 2017.

⁷ UL 60335–2–40. Standard for Safety: Household And Similar Electrical Appliances—Safety—Part 2–40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers, 3rd edition, dated November 1, 2019.

⁸ UL 60335–2–89. Standard for Safety for Household and Similar Electrical Appliances—Safety—Part 2–89: Particular Requirements for Commercial Refrigerating Appliances and Ice-Makers with an Incorporated or Remote Refrigerant Unit or Motor-Compressor. 2nd edition, dated October 27, 2021.

⁹ You may obtain the ANSI/ASHRAE material from: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), 180 Technology Parkway NW, Peachtree Corners, Georgia 30092; phone: 1–800–527–4723 or 1–404–636–8400 in the U.S. or Canada; email: cservice@ashrae.org; website: <https://www.ashrae.org/technical-resources/bookstore/ashrae-refrigeration-resources>.

¹⁰ ANSI/ASHRAE Standard 34–2022. Designation and Safety Classification of Refrigerants, copyright 2022.

¹¹ ANSI/ASHRAE Addendum a to ANSI/ASHRAE Standard 34–2022, Designation and Safety Classification of Refrigerants, ANSI/ASHRAE-approved December 20, 2022.

¹² ANSI/ASHRAE Standard 15–2022. Safety Standard for Refrigeration Systems, copyright 2022.
¹³ You may obtain the material from the United Nations Publications section at: <https://shop.un.org/books/global-harmon-syst-class-9-92280>; United Nations Publications Customer Service, P.O. Box 960, Herndon, VA 20172; phone: 1–703–661–1571; email: order@un.org.
¹⁴ ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition, copyright 2021; Chapter 2.2, Flammable Gasses, and Annex 1, Classification and Labelling Summary Tables.

* * * * *

The revisions read as follows:

**Appendix V to Subpart G of Part 82—
 Substitutes Subject to Use Restrictions
 and Unacceptable Substitutes Listed in
 the December 1, 2016, Final Rule,
 Effective January 3, 2017, and Listed in
 the June 13, 2024 Final Rule, Effective
 July 15, 2024**

- 4. Amend appendix V to subpart G of part 82 by:
 - a. Revising the heading; and
 - b. Revising the table titled “Refrigerants—Acceptable Subject to Use Conditions”.

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS

| End-use | Substitute | Decision | Use conditions | Further information |
|--|--------------------|---------------------------------------|---|--|
| 1. Commercial ice machines (self-contained) (new only) manufactured from January 3, 2017, and up to but not including 7/15/2024. | Propane (R–290) .. | Acceptable subject to use conditions. | <p>This refrigerant may be used only in new equipment designed specifically and clearly identified for the refrigerant—<i>i.e.</i>, this refrigerant may not be used as a conversion or “retrofit” refrigerant for existing equipment.</p> <p>This refrigerant may be used only in self-contained commercial ice machines that meet requirements listed in Supplement SA to UL 563.^{12 5} 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.</p> <p>The charge size must not exceed 150 g (5.29 oz) in each refrigerant circuit of a commercial ice machine.</p> <p>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:</p> <ul style="list-style-type: none"> (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. (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. (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. <p>All of these markings must be in letters no less than 6.4 mm (¼ inch) high.</p> <p>The equipment must have red Pantone® Matching System #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.</p> | <p>Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.94 (ventilation), 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).</p> <p>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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling propane. Special care should be taken to avoid contact with the skin since propane, like many refrigerants, can cause freeze burns on the skin.</p> <p>A Class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on equipment with propane. Any recovery equipment used should be designed for flammable refrigerants.</p> <p>Any refrigerant releases should be in a well-ventilated area, such as outside of a building.</p> <p>Only technicians specifically trained in handling flammable refrigerants should service equipment containing propane. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>If a service port is added then, commercial ice machines or equipment using propane 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 ¼ inch or the thread direction is reversed (<i>i.e.</i>, 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.</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---|--------------------|---------------------------------------|--|---|
| 2. Commercial ice machines (self-contained) (new only) manufactured on or after 7/15/2024, through September 29, 2024, or equipment manufactured on or after September 30, 2024, that remains unchanged, other than cosmetic changes, from an earlier model or design that was already certified to the UL 563 ^{1,2,5} standard before September 30, 2024. | Propane (R-290) .. | Acceptable subject to use conditions. | This refrigerant may be used only in self-contained commercial ice machines that meet requirements in either: 1. Supplement SA to UL 563 ^{1,2,5} and listing 1 of this table or 2. ASHRAE 15-2022, ^{1,7,8} UL 60335-2-89, ^{1,2,6} and listing 3 of this table. | |
| 3. Commercial ice machines (self-contained) (new only) manufactured on or after September 30, 2024, except for equipment manufactured on or after September 30, 2024, that remains unchanged, other than cosmetic changes, from an earlier model or design that was already certified to the UL 563 ^{1,2,5} standard before September 30, 2024. | Propane (R-290) .. | Acceptable subject to use conditions. | This refrigerant may be used only in new equipment specifically designed and clearly identified for the refrigerant (<i>i.e.</i> , none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants). This refrigerant may be used in new commercial ice machines if and only if such equipment meets all requirements in ASHRAE 15-2022 ^{1,7,8} . In cases where this listing 3 includes requirements different than those of ASHRAE 15-2022 ^{1,7,8} the appliance would need to meet the requirements of this listing in place of the requirements in ASHRAE 15-2022. This refrigerant may only be used in commercial ice machines that meet all requirements in UL 60335-2-89, ^{1,2,6} except as provided otherwise in UL 60335-2-89, in ASHRAE 15-2022, or in this listing 3. In cases where this listing includes requirements more stringent than those of UL 60335-2-89, the appliance must meet the requirements of this listing 3 in place of the requirements in the UL 60335-2-89. Where similar requirements of ASHRAE 15-2022 and UL 60335-2-89 differ, the more stringent or conservative condition shall apply unless superseded by this listing 3. The following markings must be attached at the locations provided and must be permanent: | 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), and 1910.1000 (toxic and hazardous substances). Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing flammable 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. Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin. A class B dry powder type fire extinguisher should be kept nearby. Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants. |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---------|------------|----------|---|--|
| | | | <p>(a) On the outside of the equipment: “DANGER—Risk of Fire Or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”</p> <p>(b) On the outside of the equipment: “WARNING—Risk of Fire OR Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(c) On the inside of the equipment near the compressor: “DANGER—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.”</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: “DANGER—Risk of Fire or Explosion due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations”</p> <p style="padding-left: 20px;">a. If the equipment is delivered packaged, this label shall be applied on the packaging.</p> <p style="padding-left: 20px;">b. If the equipment is not delivered packaged, this label shall be applied on the outside of the equipment near the control panel or nameplate.</p> <p>(e) On indoor units near the nameplate:</p> <p style="padding-left: 20px;">a. At the top of the marking: “Minimum Installation Height, X m (W ft)”. This marking is only required if required by UL 60335–2–89. The terms “X” and “W” shall be replaced by the numeric height as calculated per UL 60335–2–89. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p style="padding-left: 20px;">b. Immediately below (a) above or at the top of the marking if (a) is not required: “Minimum room area (operating or storage), Y m² (Z ft²)”. The terms “Y” and “Z” shall be replaced by the numeric area as calculated per UL 60335–2–89. Note that the formatting here is slightly different than UL 60335–2–89; specifically, the area in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, on the outside of the appliance: “WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition.”</p> <p>(g) For fixed equipment that is ducted, near the nameplate: “WARNING—Risk of Fire Or Explosion—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.”</p> <p>(h) All of these markings must be in letters no less than 6.4 mm (¼ inch) high.</p> | <p>Any recovery equipment used should be designed for flammable refrigerants. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex 101.DVT of UL 60355–2–89.^{1 2 5}</p> <p>Department of Transportation requirements for transport of flammable gases must be followed.</p> <p>Flammable refrigerants being recovered or otherwise disposed of from ice machine appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270).</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---|--------------------|---------------------------------------|--|--|
| 4. Very low temperature refrigeration equipment (new only). | Propane (R-290) .. | Acceptable subject to use conditions. | <p>The equipment must have red Pantone® Matching System #185 or RAL 3020 marked service ports, 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 (25 mm) in both directions from such locations and shall be replaced if removed.</p> <p>In addition to or instead of the markings described in Clause 7.6DV D1 of UL 60335-2-89, the equipment may display the Globally Harmonized System of Classification and Labelling of Chemicals GHS warning symbol for hazard category 1 flammable gases (black flame on a white background in a diamond with equal length sides with a red border), as defined in Chapter 2.2, Flammable Gasses, and Annex 1, Classification and Labelling Summary Tables, of ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition^{1 11 12}:</p> <ul style="list-style-type: none"> • Outside of the equipment (label (a)); • on the appliance packaging for a factory-charged unit or adjacent to the control panel or nameplate of a unit charged in place (label (d)); and • in a location visible when accessing a service port and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes) (service label). <p>The perpendicular height of the diamond containing the GHS warning symbol for hazard category 1 flammable gases shall be at least 15 mm (9/16 in). In addition, next to the GHS warning symbol for hazard category 1 flammable gases must be text of the refrigerant safety class of the refrigerant according to ASHRAE 34-2022,^{1 7 9 10} in letters at least one-third the height of the diamond symbol.</p> <p>As of January 3, 2017:</p> <p>This refrigerant may be used only in new equipment designed specifically and clearly identified for the refrigerant—<i>i.e.</i>, this refrigerant may not be used as a conversion or “retrofit” refrigerant for existing equipment.</p> <p>This refrigerant may only be used in equipment that meets requirements in Supplement SB to UL 471.^{1 2 4} In cases where this listing 4 of this table includes requirements more stringent than those of UL 471, the appliance must meet the requirements of this listing 4 of this table in place of the requirements in UL 471.</p> <p>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.</p> <p>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:</p> | <p>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).</p> <p>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.</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|------------------------------|--------------------|---------------------------------------|---|--|
| 5. Water coolers (new only). | Propane (R-290) .. | Acceptable subject to use conditions. | <p>(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.</p> <p>(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.</p> <p>(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.</p> <p>(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.</p> <p>(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.</p> <p>All of these markings must be in letters no less than 6.4 mm (1/4 inch) high.</p> <p>The equipment must have red Pantone® Matching System #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.</p> <p>This refrigerant may be used only in new equipment designed specifically and clearly identified for the refrigerant—<i>i.e.</i>, this refrigerant may not be used as a conversion or "retrofit" refrigerant for existing equipment.</p> <p>This refrigerant may be used only in water coolers that meet requirements listed in Supplement SB to UL 399^{1 2 3} In cases where this listing 5 includes requirements more stringent than those of UL 399, the appliance must meet the requirements of this listing 5 in place of the requirements in UL 399.</p> <p>The charge size must not exceed 60 grams (2.12 ounces) per refrigerant circuit in the water cooler.</p> <p>The equipment must have red Pantone® Matching System #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.</p> <p>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:</p> | <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling propane. Special care should be taken to avoid contact with the skin since propane, like many refrigerants, can cause freeze burns on the skin.</p> <p>A Class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants.</p> <p>Any refrigerant releases should be in a well-ventilated area, such as outside of a building.</p> <p>Only technicians specifically trained in handling flammable refrigerants should service equipment containing propane. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>If a service port is added, then very low temperature equipment using propane 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>i.e.</i>, 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.</p> <p>Very low temperature equipment using propane may also use another acceptable refrigerant substitute in a separate refrigerant circuit or stage (<i>e.g.</i>, one temperature stage with propane and a second stage with ethane).</p> <p>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).</p> <p>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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling propane. Special care should be taken to avoid contact with the skin since propane, like many refrigerants, can cause freeze burns on the skin.</p> <p>A Class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on equipment with flammable refrigerants.</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---------|------------|----------|--|--|
| | | | <p>(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.</p> <p>(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.</p> <p>(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.</p> <p>(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.</p> <p>(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.</p> | <p>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 propane. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>If a service port is added, then water coolers or equipment using propane 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>i.e.</i>, 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.</p> |

¹ The Director of the Federal Register approves this incorporation by reference (5 U.S.C. 552(a) and 1 CFR part 51). You may inspect a copy at the U.S. EPA or at the National Archives and Records Administration (NARA). Contact the U.S. EPA at: EPA Docket Center, WJC West Building, Room 3334, 1301 Constitution Avenue NW, Washington, DC 20004, www.epa.gov/dockets; (202) 202-1744. For information on the availability of this material at NARA, visit www.archives.gov/federal-register/cfr/ibr-locations or email fr.inspection@nara.gov.

² You may obtain the UL material from: Underwriters Laboratories Inc. (UL) COMM 2000; 151 Eastern Avenue; Bensenville, IL 60106; phone: 1-888-853-3503 in the U.S. or Canada (other countries +1-415-352-2168); email: orders@shopulstandards.com; website: <https://ulstandards.ul.com> or www.shopulstandards.com.

³ UL 399, Standard for Safety: Drinking Water Coolers—Supplement SB: Requirements for Drinking Water Coolers Employing a Flammable Refrigerant in the Refrigerating System, 7th edition, dated August 22, 2008, including revisions through October 17, 2013.

⁴ UL 471, Standard for Safety: Commercial Refrigerators and Freezers. Supplement SB: Requirements for Refrigerators and Freezers Employing a Flammable Refrigerant in the Refrigerating System, 10th edition, dated November 24, 2010.

⁵ UL 563, Standard for Safety: Ice Makers. Supplement SA: Requirements for Ice Makers Employing a Flammable Refrigerant in the Refrigerating System, 8th edition, dated July 31, 2009, including revisions through November 29, 2013.

⁶ UL 60335-2-89, Standard for Safety for Household and Similar Electrical Appliances—Safety—Part 2-89: Particular Requirements for Commercial Refrigerating Appliances, 2nd edition, dated October 27, 2021.

⁷ You may obtain the ANSI/ASHRAE material from: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), 180 Technology Parkway NW, Peachtree Corners, Georgia 30092; phone: 1-800-527-4723 or 1-404-636-8400 in the U.S. or Canada; email: cservice@ashrae.org; website: <https://www.ashrae.org/technical-resources/bookstore/ashrae-refrigeration-resources>.

⁸ ANSI/ASHRAE Standard 15-2022. Safety Standard for Refrigeration Systems, copyright 2022.

⁹ ANSI/ASHRAE Standard 34-2022. Designation and Safety Classification of Refrigerants, copyright 2022.

¹⁰ ANSI/ASHRAE Addendum a to ANSI/ASHRAE Standard 34-2022, Designation and Safety Classification of Refrigerants, ANSI/ASHRAE-approved December 20, 2022.

¹¹ You may obtain the UN material from the United Nations Publications section at: <https://shop.un.org/books/global-harmon-syst-class-9-92280>; by mail: United Nations Publications Customer Service, PO Box 960, Herndon, VA 20172; phone: 1-703-661-1571; email: order@un.org.

¹² ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition, copyright 2021; Chapter 2.2, Flammable Gases, and Annex 1, Classification and Labelling Summary Tables.

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■ 5. Add appendix Y to subpart G of part 82 to read as follows:

**Appendix Y to Subpart G of Part 82—
Substitutes Listed in the June 13, 2024,
Final Rule, Effective July 15, 2024**

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS

| End-use | Substitute | Decision | Use conditions | Further information |
|--|---|--|--|--|
| <p>1. Retail Food Refrigeration—Stand-alone units and refrigerated food processing and dispensing equipment, excluding refrigerated food processing and dispensing equipment that is within the scope of UL 621 (Ice Cream Makers) (New only).</p> | <p>HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A.</p> | <p>Acceptable subject to use conditions.</p> | <p>These refrigerants may be used only in new equipment specifically designed and clearly identified for the refrigerant (<i>i.e.</i>, none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>These refrigerants may be used in stand-alone units and refrigerated food processing and dispensing equipment if and only if such equipment meets requirements listed in ASHRAE 15–2022.^{1 4 5} In cases where this listing includes requirements different than those of ASHRAE 15–2022, the appliance would need to meet the requirements of this listing 1 in place of the requirements in ASHRAE 15–2022.</p> <p>These refrigerants may only be used in refrigeration equipment that meets all requirements in UL 60335–2–89,^{1 2 3} except as provided otherwise in UL 60335–2–89, in ASHRAE 15–2022, or in this listing 1. This listing 1 does not apply to refrigerated food processing and dispensing equipment that is within the scope of UL 621 (Ice Cream Makers). In cases where this listing includes requirements more stringent than those of UL 60335–2–89, the appliance must meet the requirements of this listing 1 in place of the requirements in UL 60335–2–89. Where similar requirements of ASHRAE 15–2022 and UL 60335–2–89 differ, the more stringent or conservative condition shall apply unless superseded by this listing 1.</p> <p>The following markings must be attached at the locations provided and must be permanent:</p> | <p>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), and 1910.1000 (toxic and hazardous substances).</p> <p>It is the obligation of regulated entities to inform themselves of and comply with any other applicable legal obligations or restrictions.</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing flammable 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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin.</p> <p>A class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| | | | <p>(a) On the outside of the equipment: "WARNING—Risk of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing."</p> <p>(b) On the outside of the equipment: "WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used."</p> <p>(c) On the inside of the equipment near the compressor: "WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting to Service This Product. All Safety Precautions Must be Followed."</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: "WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations"</p> <p>a. If the equipment is delivered packaged, this label shall be applied on the packaging.</p> <p>b. If the equipment is not delivered packaged, this label shall be applied on the outside of the equipment near the control panel or nameplate.</p> <p>(e) On the equipment near the nameplate:</p> <p>a. At the top of the marking: "Minimum Installation Height, X m (W ft)". This marking is only required if required by UL 60335-2-89. The terms "X" and "W" shall be replaced by the numeric height as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>b. Immediately below (a) above or at the top of the marking if (a) is not required: "Minimum room area (operating or storage), Y m² (Z ft²)". The terms "Y" and "Z" shall be replaced by the numeric area as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the area in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, on the outside of the product: "WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition."</p> <p>(g) For fixed equipment that is ducted, near the nameplate: "WARNING—Risk of Fire—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions."</p> <p>(h) All of these markings must be in letters no less than 6.4 mm (1/4 inch) high.</p> <p>The equipment must have red Pantone® Matching System #185 or RAL 3020 marked service ports, 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 (25mm) in both directions from such locations and shall be replaced if removed.</p> | <p>Any recovery equipment used should be designed for flammable refrigerants. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex 101.DVT of UL 60355-2-89.^{1 2 3}</p> <p>CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration.</p> <p>Department of Transportation requirements for transport of flammable gases must be followed.</p> <p>Flammable refrigerants being recovered or otherwise disposed of from retail food refrigeration appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270).</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| <p>2. Retail Food Refrigeration—Refrigerated food processing and dispensing equipment (New only)—excluding refrigerated food processing and dispensing equipment that is within the scope of UL 621 (Ice Cream Makers).</p> | <p>Propane (R-290) ..</p> | <p>Acceptable subject to use conditions.</p> | <p>In addition to or instead of the markings described in Clause 7.6DV D1 of UL 60335-2-89, the equipment may display the GHS warning symbol for hazard category 1 flammable gases (black flame on a white background in a diamond with equal length sides with a red border) as defined in Chapter 2.2, Flammable Gases, and Annex 1, Classification and Labelling Summary Tables, of ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition^{1 8 9} on the following three locations:</p> <ul style="list-style-type: none"> • Outside of the equipment (label (a)); • on the appliance packaging for a factory-charged unit or adjacent to the control panel or nameplate of a unit charged in place (label (d)); and • in a location visible when accessing a service port and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes) (service label). <p>The perpendicular height of the diamond containing the GHS warning symbol for hazard category 1 flammable gases shall be at least 15 mm (⁹/₁₆ in). In addition, next to the GHS warning symbol for hazard category 1 flammable gases must be text of the refrigerant safety class of the refrigerant according to ASHRAE 34-2022,^{1 4 6 7} in letters at least one-third the height of the diamond symbol.</p> <p>This refrigerant may be used only in new equipment specifically designed and clearly identified for the refrigerant (<i>i.e.</i>, the substitute may not be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>This refrigerant may be used in refrigerated food processing and dispensing equipment if and only if such equipment meets requirements listed in ASHRAE 15-2022.^{1 4 5} In cases where this listing 2 includes requirements different than those of ASHRAE 15-2022, the appliance would need to meet the requirements of this listing 2 in place of requirements in the ASHRAE Standard.</p> <p>These refrigerants may only be used in refrigeration equipment that meets all requirements in UL 60335-2-89,^{1 2 3} except as provided otherwise in UL 60335-2-89, in ASHRAE 15-2022, or in this listing 2. This listing 2 does not apply to refrigerated food processing and dispensing equipment that is within the scope of UL 621 (Ice Cream Makers). In cases where this listing includes requirements more stringent than those of UL 60335-2-89, the appliance must meet the requirements of this listing 2 in place of the requirements in UL 60335-2-89. Where similar requirements of ASHRAE 15-2022 and UL 60335-2-89 differ, the more stringent or conservative condition shall apply unless superseded by this listing 2.</p> <p>The following markings must be attached at the locations provided and must be permanent:</p> | <p>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), and 1910.1000 (toxic and hazardous substances).</p> <p>It is the obligation of regulated entities to inform themselves of and comply with any other applicable legal obligations or restrictions.</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing flammable 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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin.</p> <p>A class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| | | | <p>(a) On the outside of the equipment: “DANGER—Risk of Fire Or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”</p> <p>(b) On the outside of the equipment: “WARNING—Risk of Fire Or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(c) On the inside of the equipment near the compressor: “DANGER—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.”</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: “DANGER—Risk of Fire or Explosion due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations”</p> <p style="padding-left: 20px;">a. If the equipment is delivered packaged, this label shall be applied on the packaging.</p> <p style="padding-left: 20px;">b. If the equipment is not delivered packaged, this label shall be applied on the outside of the equipment near the control panel or nameplate.</p> <p>(e) On the equipment near the nameplate:</p> <p style="padding-left: 20px;">a. At the top of the marking: “Minimum Installation Height, X m (W ft)”. This marking is only required if required by UL 60335–2–89. The terms “X” and “W” shall be replaced by the numeric height as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p style="padding-left: 20px;">b. Immediately below (a) above or at the top of the marking if (a) is not required: “Minimum room area (operating or storage), Y m² (Z ft²)”. The terms “Y” and “Z” shall be replaced by the numeric area as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the area in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, on the outside of the product: “WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition.”</p> <p>(g) For fixed equipment that is ducted, near the nameplate: “WARNING—Risk of Fire or Explosion—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.”</p> <p>(h) All of these markings must be in letters no less than 6.4 mm (¼ inch) high.</p> <p>The equipment must have red Pantone® Matching System #185 or RAL 3020 marked service ports, 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 (25mm) in both directions from such locations and shall be replaced if removed.</p> | <p>Any recovery equipment used should be designed for flammable refrigerants. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex 101.DVT of UL 260355–2–89.^{1 2 3}</p> <p>CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration.</p> <p>Department of Transportation requirements for transport of flammable gases must be followed.</p> <p>Flammable refrigerants being recovered or otherwise disposed of from retail food refrigeration appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270).</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| <p>3. Retail Food Refrigeration—Remote condensing units and supermarket systems (New only).</p> | <p>HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A.</p> | <p>Acceptable subject to use conditions.</p> | <p>In addition to or instead of the markings described in Clause 7.6DV D1 of UL 60335-2-89, the equipment may display the GHS warning symbol for hazard category 1 flammable gases (black flame on a white background in a diamond with equal length sides with a red border), as defined in Chapter 2.2, Flammable Gases, and Annex 1, Classification and Labelling Summary Tables, of ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition^{1 8 9} on the following three locations:</p> <ul style="list-style-type: none"> • Outside of the equipment (label (a)); • on the appliance packaging for a factory-charged unit or adjacent to the control panel or nameplate of a unit charged in place (label (d)); and • in a location visible when accessing a service port and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes) (service label). <p>The perpendicular height of the diamond containing the GHS warning symbol for hazard category 1 flammable gases shall be at least 15 mm (9/16 in). In addition, next to the GHS warning symbol for hazard category 1 flammable gases must be text of the refrigerant safety class of the refrigerant according to ASHRAE 34-2022,^{1 4 6 7} in letters at least one-third the height of the diamond symbol.</p> <p>These refrigerants may be used only in new equipment specifically designed and clearly identified for the refrigerant (i.e., none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>These refrigerants may be used in remote condensing units and supermarket systems if and only if such equipment meets requirements listed in ASHRAE 15-2022.^{1 4 5} In cases where this listing includes requirements different than those of ASHRAE 15-2022, the appliance would need to meet the requirements of this listing 3 in place of requirements in the ASHRAE Standard.</p> <p>These refrigerants may only be used in refrigeration equipment that meets all requirements in UL 60335-2-89,^{1 2 3} except as provided otherwise in UL 60335-2-89, in ASHRAE 15-2022, or in this listing 3. In cases where this listing includes requirements more stringent than those of UL 60335-2-89, the appliance must meet the requirements of this listing 3 in place of the requirements in UL 60335-2-89. Where similar requirements of ASHRAE 15-2022 and UL 60335-2-89 differ, the more stringent or conservative condition shall apply unless superseded by this listing 3.</p> <p>The following markings must be attached at the locations provided and must be permanent:</p> | <p>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), and 1910.1000 (toxic and hazardous substances).</p> <p>It is the obligation of regulated entities to inform themselves of and comply with any other applicable legal obligations or restrictions.</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing flammable 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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin.</p> <p>A class B dry powder type fire extinguisher should be kept nearby.</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| | | | <p>(a) On the outside of the equipment: "WARNING—Risk of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing."</p> <p>(b) On the outside of the equipment: "WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used."</p> <p>(c) On the inside of the equipment near the compressor: "WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting to Service This Product. All Safety Precautions Must be Followed."</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: "WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations"</p> <p>a. If the equipment is delivered packaged, this label shall be applied on the packaging.</p> <p>b. If the equipment is not delivered packaged, this label shall be applied on the outside of the equipment near the control panel or nameplate.</p> <p>(e) On the equipment near the nameplate:</p> <p>a. At the top of the marking: "Minimum Installation Height, X m (W ft)". This marking is only required if required by UL 60335-2-89. The terms "X" and "W" shall be replaced by the numeric height as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>b. Immediately below (a) above or at the top of the marking if (a) is not required: "Minimum room area (operating or storage), Y m² (Z ft²)". The terms "Y" and "Z" shall be replaced by the numeric area as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the area in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, on the outside of the product: "WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition."</p> <p>(g) For fixed equipment that is ducted, near the nameplate: "WARNING—Risk of Fire—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions."</p> <p>(h) All of these markings must be in letters no less than 6.4 mm (¼ inch) high.</p> <p>The equipment must have red Pantone® Matching System #185 or RAL 3020 marked service ports, 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 (25 mm) in both directions from such locations and shall be replaced if removed.</p> | <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex 101.DVT of UL 260355-2-89.^{1 2 3}</p> <p>CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration.</p> <p>Department of Transportation requirements for transport of flammable gases must be followed.</p> <p>Flammable refrigerants being recovered or otherwise disposed of from retail food refrigeration appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270).</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| <p>4. Commercial Ice Machines (New only).</p> | <p>HFO-1234yf, R-454C, R-455A, R-457A, and R-516A.</p> | <p>Acceptable subject to use conditions.</p> | <p>In addition to or instead of the markings described in Clause 7.6DV D1 of UL 60335-2-89, the equipment may display the GHS warning symbol for hazard category 1 flammable gases (black flame on a white background in a diamond with equal length sides with a red border), as defined in Chapter 2.2, Flammable Gasses, and Annex 1, Classification and Labelling Summary Tables, of ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition,^{1 8 9} on the following three locations:</p> <ul style="list-style-type: none"> • Outside of the equipment (label (a)); • on the appliance packaging for a factory-charged unit or adjacent to the control panel or nameplate of a unit charged in place (label (d)); and • in a location visible when accessing a service port and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes) (service label) <p>The perpendicular height of the diamond containing the GHS warning symbol for hazard category 1 flammable gases shall be at least 15 mm (⁹/₁₆ in). In addition, next to the GHS warning symbol for hazard category 1 flammable gases must be text of the refrigerant safety class of the refrigerant according to ASHRAE 34-2022,^{1 4 6 7} in letters at least one-third the height of the diamond symbol.</p> <p>The substitute R-454A may only be used in equipment with a refrigerant charge capacity less than 200 pounds, or in the high-temperature side of a cascade system.</p> <p>These refrigerants may be used only in new equipment specifically designed and clearly identified for the refrigerant (i.e., none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>These refrigerants may be used in new commercial ice machines if and only if such equipment meets requirements listed in ASHRAE 15-2022.^{1 4 5} In cases where this listing includes requirements different than those of ASHRAE 15-2022, the appliance would need to meet the requirements of this listing 4 in place of the requirements in ASHRAE 15-2022.</p> <p>These refrigerants may only be used in refrigeration equipment that meets all requirements in UL 60335-2-89,^{1 2 3} except as provided otherwise in UL 60335-2-89, in ASHRAE 15-2022, or in this listing 4. In cases where this listing includes requirements more stringent than those of UL 60335-2-89, the appliance must meet the requirements of this listing 4 in place of the requirements in UL 60335-2-89. Where similar requirements of ASHRAE 15-2022 and UL 60335-2-89 differ, the more stringent or conservative condition shall apply unless superseded by this listing 4. condition shall apply unless superseded by this listing 4.</p> <p>The following markings must be attached at the locations provided and must be permanent:</p> | <p>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), and 1910.1000 (toxic and hazardous substances).</p> <p>It is the obligation of regulated entities to inform themselves of and comply with any other applicable legal obligations or restrictions.</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing flammable 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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin.</p> <p>A class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| | | | <p>(a) On the outside of the equipment: "WARNING—Risk of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing."</p> <p>(b) On the outside of the equipment: "WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used."</p> <p>(c) On the inside of the equipment near the compressor: "WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting to Service This Product. All Safety Precautions Must be Followed."</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: "WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations"</p> <p>a. If the equipment is delivered packaged, this label shall be applied on the packaging.</p> <p>b. If the equipment is not delivered packaged, this label shall be applied on the outside of the equipment near the control panel or nameplate.</p> <p>(e) On the equipment near the nameplate:</p> <p>a. At the top of the marking: "Minimum Installation Height, X m (W ft)". This marking is only required if required by UL 60335–2–89. The terms "X" and "W" shall be replaced by the numeric height as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>b. Immediately below (a) above or at the top of the marking if (a) is not required: "Minimum room area (operating or storage), Y m² (Z ft²)". The terms "Y" and "Z" shall be replaced by the numeric area as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the area in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, on the outside of the product: "WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition."</p> <p>(g) For fixed equipment that is ducted, near the nameplate: "WARNING—Risk of Fire—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions."</p> <p>(h) All of these markings must be in letters no less than 6.4 mm (¼ inch) high.</p> | <p>Any recovery equipment used should be designed for flammable refrigerants. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex 101.DVT of UL 260355–2–89.^{1 2 3}</p> <p>CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration.</p> <p>Department of Transportation requirements for transport of flammable gases must be followed.</p> <p>Flammable refrigerants being recovered or otherwise disposed of from commercial ice machine appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270).</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| <p>5. Commercial Ice Machines (New only)—as of 7/15/2024, for commercial ice machines with a remote compressor, for batch-type self-contained automatic commercial ice machines with a harvest rate above 1,000 lb ice per 24 hours and for continuous type self-contained automatic commercial ice machines with a harvest rate above 1,200 lb ice per 24 hours; for other types, as of [date reserved].</p> | <p>HFC-32, R-454A, R-454B.</p> | <p>Acceptable subject to use conditions.</p> | <p>The equipment must have red Pantone® Matching System #185 or RAL 3020 marked service ports, 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 (25mm) in both directions from such locations and shall be replaced if removed.</p> <p>In addition to or instead of the markings described in Clause 7.6DV D1 of UL 60335-2-89, the equipment may display the GHS warning symbol for hazard category 1 flammable gases (black flame on a white background in a diamond with equal length sides with a red border), as defined in Chapter 2.2, Flammable Gasses, and Annex 1, Classification and Labelling Summary Tables, of ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition,^{1 8 9} on the following three locations:</p> <ul style="list-style-type: none"> • Outside of the equipment (label (a)); • on the appliance packaging for a factory-charged unit or adjacent to the control panel or nameplate of a unit charged in place (label (d)); and • in a location visible when accessing a service port and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes) (service label). <p>The perpendicular height of the diamond containing the GHS warning symbol for hazard category 1 flammable gases shall be at least 15 mm (⁹/₁₆ in). In addition, next to the GHS warning symbol for hazard category 1 flammable gases must be text of the refrigerant safety class of the refrigerant according to ASHRAE 34-2022,^{1 4 6 7} in letters at least one-third the height of the diamond symbol.</p> <p>These refrigerants may be used only in new equipment specifically designed and clearly identified for the refrigerant (i.e., none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>These refrigerants may be used in new commercial ice machines if and only if such equipment meets requirements in ASHRAE 15-2022.^{1 4 5} In cases where this listing includes requirements different than those of ASHRAE 15-2022, the appliance would need to meet the requirements of this listing 5 in place of the requirements in ASHRAE 15-2022.</p> <p>These refrigerants may only be used in refrigeration equipment that meets all requirements in UL 60335-2-89,^{1 2 3} except as provided otherwise in UL 60335-2-89, in ASHRAE 15-2022, or in this listing 5. In cases where this listing includes requirements more stringent than those of UL 60335-2-89, the appliance must meet the requirements of this listing 5 in place of the requirements in UL 60335-2-89. Where similar requirements of ASHRAE 15-2022 and UL 60335-2-89 differ, the more stringent or conservative condition shall apply unless superseded by this listing 5.</p> <p>The following markings must be attached at the locations provided and must be permanent:</p> | <p>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), and 1910.1000 (toxic and hazardous substances).</p> <p>It is the obligation of regulated entities to inform themselves of and comply with any other applicable legal obligations or restrictions.</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing flammable 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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin.</p> <p>A class B dry powder type fire extinguisher should be kept nearby.</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| | | | <p>(a) On the outside of the equipment: "WARNING—Risk of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing."</p> <p>(b) On the outside of the equipment: "WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used."</p> <p>(c) On the inside of the equipment near the compressor: "WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting to Service This Product. All Safety Precautions Must be Followed."</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: "WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations"</p> <p>a. If the equipment is delivered packaged, this label shall be applied on the packaging.</p> <p>b. If the equipment is not delivered packaged, this label shall be applied on the outside of the equipment near the control panel or nameplate.</p> <p>(e) On the equipment near the nameplate:</p> <p>a. At the top of the marking: "Minimum Installation Height, X m (W ft)". This marking is only required if required by UL 60335-2-89. The terms "X" and "W" shall be replaced by the numeric height as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>b. Immediately below (a) above or at the top of the marking if (a) is not required: "Minimum room area (operating or storage), Y m² (Z ft²)". The terms "Y" and "Z" shall be replaced by the numeric area as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the area in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, on the outside of the product: "WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition."</p> <p>(g) For fixed equipment that is ducted, near the nameplate: "WARNING—Risk of Fire—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions."</p> <p>(h) All of these markings must be in letters no less than 6.4 mm (¼ inch) high.</p> <p>The equipment must have red Pantone® Matching System #185 or RAL 3020 marked service ports, 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 (25mm) in both directions from such locations and shall be replaced if removed.</p> | <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex 101.DVT of UL 260355-2-89.^{1 2 3}</p> <p>CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration.</p> <p>Department of Transportation requirements for transport of flammable gases must be followed.</p> <p>Flammable refrigerants being recovered or otherwise disposed of from commercial ice machine appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270).</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| <p>6. Industrial Process Refrigeration (New only).</p> | <p>HFC-32, HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A.</p> | <p>Acceptable subject to use conditions.</p> | <p>In addition to or instead of the markings described in Clause 7.6DV D1 of UL 60335-2-89, the equipment may display the GHS warning symbol for hazard category 1 flammable gases (black flame on a white background in a diamond with equal length sides with a red border), as defined in Chapter 2.2, Flammable Gases, and Annex 1, Classification and Labelling Summary Tables, of ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition^{1 8 9} on the following three locations:</p> <ul style="list-style-type: none"> • Outside of the equipment (label (a)); • on the appliance packaging for a factory-charged unit or adjacent to the control panel or nameplate of a unit charged in place (label (d)); and • in a location visible when accessing a service port and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes) (service label). <p>The perpendicular height of the diamond containing the GHS warning symbol for hazard category 1 flammable gases shall be at least 15 mm (5/16 in). In addition, next to the GHS warning symbol for hazard category 1 flammable gases must be text of the refrigerant safety class of the refrigerant according to ASHRAE 34-2022,^{1 4 6 7} in letters at least one-third the height of the diamond symbol.</p> <p>These refrigerants may be used only in new equipment specifically designed and clearly identified for the refrigerant (i.e., none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>These refrigerants may be used in industrial process refrigeration equipment if and only if such equipment meets requirements in ASHRAE 15-2022.^{1 4 5} In cases where this listing includes requirements different than those of ASHRAE 15-2022, the appliance would need to meet the requirements of this listing 6 in place of the requirements in ASHRAE 15-2022.</p> <p>These refrigerants may only be used in refrigeration equipment that meets all requirements in UL 60335-2-89,^{1 2 3} except as provided otherwise in UL 60335-2-89, in ASHRAE 15-2022, or in this listing 6. In cases where this listing includes requirements more stringent than those of UL 60335-2-89, the appliance must meet the requirements of this listing 6 in place of the requirements in UL 60335-2-89. Where similar requirements of ASHRAE 15-2022 and UL 60335-2-89 differ, the more stringent or conservative condition shall apply unless superseded by this listing 6.</p> | <p>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), and 1910.1000 (toxic and hazardous substances).</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing flammable 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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin.</p> <p>A class B dry powder type fire extinguisher should be kept nearby.</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| | | | <p>The following markings must be attached at the locations provided and must be permanent:</p> <p>(a) On the outside of the equipment: “WARNING—Risk of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”</p> <p>(b) On the outside of the equipment: “WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(c) On the inside of the equipment near the compressor: “WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner’s Guide Before Attempting to Service This Product. All Safety Precautions Must be Followed.”</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: “WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations”</p> <p>a. If the equipment is delivered packaged, this label shall be applied on the packaging.</p> <p>b. If the equipment is not delivered packaged, this label shall be applied on the outside of the equipment near the control panel or nameplate.</p> <p>(e) On the equipment near the nameplate:</p> <p>a. At the top of the marking: “Minimum Installation Height, X m (W ft)”. This marking is only required if required by UL 60335–2–89. The terms “X” and “W” shall be replaced by the numeric height as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p>b. Immediately below (a) above or at the top of the marking if (a) is not required: “Minimum room area (operating or storage), Y m² (Z ft²)”. The terms “Y” and “Z” shall be replaced by the numeric area as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the area in Inch-Pound units is placed in parentheses and the word “and” has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, on the outside of the product: “WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition.”</p> <p>(g) For fixed equipment that is ducted, near the nameplate: “WARNING—Risk of Fire—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions.”</p> <p>(h) All of these markings must be in letters no less than 6.4 mm (¼ inch) high.</p> | <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex 101.DVT of UL 260355–2–89.^{1 2 3}</p> <p>CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration.</p> <p>Department of Transportation requirements for transport of flammable gases must be followed.</p> <p>Flammable refrigerants being recovered or otherwise disposed of from industrial process refrigeration appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270).</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| | | | <p>The equipment must have red Pantone® Matching System #185 or RAL 3020 marked service ports, 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 (25mm) in both directions from such locations and shall be replaced if removed.</p> <p>In addition to or instead of the markings described in Clause 7.6DV D1 of UL 60335-2-89, the equipment may display the GHS warning symbol for hazard category 1 flammable gases (black flame on a white background in a diamond with equal length sides with a red border), as defined in Chapter 2.2, Flammable Gasses, and Annex 1, Classification and Labelling Summary Tables, of ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition,^{1 8 9} on the following three locations:</p> <ul style="list-style-type: none"> • Outside of the equipment (label (a)); • on the appliance packaging for a factory-charged unit or adjacent to the control panel or nameplate of a unit charged in place (label (d)); and • in a location visible when accessing a service port and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes) (service label). <p>The perpendicular height of the diamond containing the GHS warning symbol for hazard category 1 flammable gases shall be at least 15 mm (⁹/₁₆ in). In addition, next to the GHS warning symbol for hazard category 1 flammable gases must be text of the refrigerant safety class of the refrigerant according to ASHRAE 34-2022,^{1 4 6 7} in letters at least one-third the height of the diamond symbol.</p> <p>The substitute R-454A may only be used in chillers for industrial process refrigeration, in equipment with the refrigerant temperature entering the evaporator less than or equal to -30 °C, in equipment with a refrigerant charge capacity less than 200 pounds and with the refrigerant temperature entering the evaporator higher than -30 °C, and in the high-temperature side of a cascade system with the refrigerant temperature entering the evaporator higher than -30 °C.</p> <p>The substitutes HFC-32 and R-454B may only be used in chillers for industrial process refrigeration, or in equipment with the refrigerant temperature entering the evaporator less than or equal to -30 °C.</p> | |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| 7. Cold Storage Warehouses (New only). | HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A. | Acceptable subject to use conditions. | <p>These refrigerants may be used only in new equipment specifically designed and clearly identified for the refrigerant (<i>i.e.</i>, none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>These refrigerants may be used in cold storage warehouses if and only if such equipment meets requirements in ASHRAE 15–2022.^{1 4 5} In cases where this listing includes requirements different than those of ASHRAE 15–2022, the appliance would need to meet the requirements of this listing 7 in place of the requirements in ASHRAE 15–2022.</p> <p>These refrigerants may only be used in refrigeration equipment that meets all requirements in UL 60335–2–89,^{1 2 3} except as provided otherwise in UL 60335–2–89, in ASHRAE 15–2022, or in this listing 7. In cases where this listing includes requirements more stringent than those of UL 60335–2–89, the appliance must meet the requirements of this listing 7 in place of the requirements in UL 60335–2–89. Where similar requirements of ASHRAE 15–2022 and UL 60335–2–89 differ, the more stringent or conservative condition shall apply unless superseded by this listing 7.</p> <p>The following markings must be attached at the locations provided and must be permanent:</p> <p>(a) On the outside of the equipment: “WARNING—Risk of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”</p> <p>(b) On the outside of the equipment: “WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(c) On the inside of the equipment near the compressor: “WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner’s Guide Before Attempting to Service This Product. All Safety Precautions Must be Followed.”</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: “WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations”</p> <p>a. If the equipment is delivered packaged, this label shall be applied on the packaging.</p> <p>b. If the equipment is not delivered packaged, this label shall be applied on the outside of the equipment near the control panel or nameplate.</p> | <p>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), and 1910.1000 (toxic and hazardous substances).</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing flammable 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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin.</p> <p>A class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex 101.DVT of UL 260355–2–89.^{1 2 3}</p> <p>CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration.</p> <p>Department of Transportation requirements for transport of flammable gases must be followed.</p> <p>Flammable refrigerants being recovered or otherwise disposed of from cold storage warehouses are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270).</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---------|------------|----------|--|---------------------|
| | | | <p>(e) On the equipment near the nameplate:</p> <p>a. At the top of the marking: "Minimum Installation Height, X m (W ft)". This marking is only required if required by UL 60335-2-89. The terms "X" and "W" shall be replaced by the numeric height as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>b. Immediately below (a) above or at the top of the marking if (a) is not required: "Minimum room area (operating or storage), Y m² (Z ft²)". The terms "Y" and "Z" shall be replaced by the numeric area as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the area in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, on the outside of the product: "WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition."</p> <p>(g) For fixed equipment that is ducted, near the nameplate: "WARNING—Risk of Fire—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions."</p> <p>(h) All of these markings must be in letters no less than 6.4 mm (1/4 inch) high.</p> <p>The equipment must have red Pantone® Matching System #185 or RAL 3020 marked service ports, 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 (25mm) in both directions from such locations and shall be replaced if removed.</p> <p>In addition to or instead of the markings described in Clause 7.6DV D1 of UL 60335-2-89, the equipment may display the GHS warning symbol for hazard category 1 flammable gases (black flame on a white background in a diamond with equal length sides with a red border), as defined in Chapter 2.2, Flammable Gasses, and Annex 1, Classification and Labelling Summary Tables, of ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition,^{1 8 9} on the following three locations:</p> <ul style="list-style-type: none"> • Outside of the equipment (label (a)); • on the appliance packaging for a factory-charged unit or adjacent to the control panel or nameplate of a unit charged in place (label (d)); and • in a location visible when accessing a service port and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes) (service label). | |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
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| 8. Ice Skating Rinks (New only; Equipment with remote compressors). | HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A. | Acceptable subject to use conditions. | <p>The perpendicular height of the diamond containing the GHS warning symbol for hazard category 1 flammable gases shall be at least 15 mm ($\frac{9}{16}$ in). In addition, next to the GHS warning symbol for hazard category 1 flammable gases must be text of the refrigerant safety class of the refrigerant to ASHRAE 34-2022,^{1,4,6,7} in letters at least one-third the height of the diamond symbol.</p> <p>The substitute R-454A may only be used either in equipment with a refrigerant charge capacity less than 200 pounds or in the high-temperature side of a cascade system.</p> <p>These refrigerants may be used only in new equipment specifically designed and clearly identified for the refrigerant (<i>i.e.</i>, none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants).</p> <p>These refrigerants may be used in ice skating rinks with remote compressors if and only if such equipment meets requirements in ASHRAE 15-2022.^{1,4,5} In cases where this listing includes requirements different than those of ASHRAE 15-2022, the appliance would need to meet the requirements of this listing 8 in place of the requirements in ASHRAE 15-2022.</p> <p>These refrigerants may only be used in refrigeration equipment that meets all requirements in UL 60335-2-89,^{1,2,3} except as provided otherwise in UL 60335-2-89, in ASHRAE 15-2022, or in this listing 8. In cases where this listing includes requirements more stringent than those of UL 60335-2-89, the appliance must meet the requirements of this listing 8 in place of the requirements in UL 60335-2-89. Where similar requirements of ASHRAE 15-2022 and UL 60335-2-89 differ, the more stringent or conservative condition shall apply unless superseded by this listing 8.</p> <p>The following markings must be attached at the locations provided and must be permanent:</p> <p>(a) On the outside of the equipment: “WARNING—Risk of Fire. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.”</p> <p>(b) On the outside of the equipment: “WARNING—Risk of Fire. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.”</p> <p>(c) On the inside of the equipment near the compressor: “WARNING—Risk of Fire. Flammable Refrigerant Used. Consult Repair Manual/Owner’s Guide Before Attempting to Service This Product. All Safety Precautions Must be Followed.”</p> <p>(d) For any equipment pre-charged at the factory, on the equipment packaging or on the outside of the equipment: “WARNING—Risk of Fire due to Flammable Refrigerant Used. Follow Handling Instructions Carefully in Compliance with National Regulations”</p> <p>a. If the equipment is delivered packaged, this label shall be applied on the packaging.</p> <p>b. If the equipment is not delivered packaged, this label shall be applied on the outside of the equipment near the control panel or nameplate.</p> | <p>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), and 1910.1000 (toxic and hazardous substances).</p> <p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing flammable 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.</p> <p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling flammable refrigerants. Special care should be taken to avoid contact with the skin which, like many refrigerants, can cause freeze burns on the skin.</p> <p>A class B dry powder type fire extinguisher should be kept nearby.</p> <p>Technicians should only use spark-proof tools when working on air conditioning equipment with flammable refrigerants.</p> <p>Any recovery equipment used should be designed for flammable refrigerants. Only technicians specifically trained in handling flammable refrigerants should service refrigeration equipment containing this refrigerant. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p> <p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p> <p>Personnel commissioning, maintaining, repairing, decommissioning and disposing of appliances with this refrigerant should obtain training and follow practices consistent with Annex 101.DVT of UL 260355-2-89.^{2,3}</p> <p>CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of maintaining, servicing, repairing or disposing of an appliance or industrial process refrigeration.</p> <p>Department of Transportation requirements for transport of flammable gases must be followed.</p> <p>Flammable refrigerants being recovered or otherwise disposed of from ice skating rinks are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260 through 270).</p> |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---------|------------|----------|---|---------------------|
| | | | <p>(e) On the equipment near the nameplate:</p> <p>a. At the top of the marking: "Minimum Installation Height, X m (W ft)". This marking is only required if required by UL 60335-2-89. The terms "X" and "W" shall be replaced by the numeric height as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the height in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>b. Immediately below (a) above or at the top of the marking if (a) is not required: "Minimum room area (operating or storage), Y m² (Z ft²)". The terms "Y" and "Z" shall be replaced by the numeric area as calculated per the UL Standard. Note that the formatting here is slightly different than the UL Standard; specifically, the area in Inch-Pound units is placed in parentheses and the word "and" has been replaced by the opening parenthesis.</p> <p>(f) For non-fixed equipment, on the outside of the product: "WARNING—Risk of Fire or Explosion—Store in a well-ventilated room without continuously operating flames or other potential ignition."</p> <p>(g) For fixed equipment that is ducted, near the nameplate: "WARNING—Risk of Fire—Auxiliary devices which may be ignition sources shall not be installed in the ductwork, other than auxiliary devices listed for use with the specific appliance. See instructions."</p> <p>(h) All of these markings must be in letters no less than 6.4 mm (1/4 inch) high.</p> <p>The equipment must have red Pantone® Matching System #185 or RAL 3020 marked service ports, 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 (25mm) in both directions from such locations and shall be replaced if removed.</p> <p>In addition to or instead of the markings described in Clause 7.6DV D1 of UL 60335-2-89, the equipment may display the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) warning symbol for hazard category 1 flammable gases¹⁷⁸ (black flame on a white background in a diamond with equal length sides with a red border) on the following three locations:</p> <ul style="list-style-type: none"> • outside of the equipment (label (a)); • on the appliance packaging for a factory-charged unit or adjacent to the control panel or nameplate of a unit charged in place (label (d)); and • in a location visible when accessing a service port and where service puncturing or otherwise creating an opening from the refrigerant circuit to the atmosphere might be expected (e.g., process tubes) (service label). | |

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS—Continued

| End-use | Substitute | Decision | Use conditions | Further information |
|---------|------------|----------|---|---------------------|
| | | | The perpendicular height of the diamond containing the GHS warning symbol for hazard category 1 flammable gases shall be at least 15 mm ($\frac{9}{16}$ in). In addition, next to the GHS warning symbol for hazard category 1 flammable gases must be text of the refrigerant safety class of the refrigerant according to ASHRAE 34–2022, ^{1 4 6 7} in letters at least one-third the height of the diamond symbol. | |

¹ The Director of the Federal Register approves this incorporation by reference (5 U.S.C. 552(a) and 1 CFR part 51). You may inspect a copy at the U.S. EPA or at the National Archives and Records Administration (NARA). Contact the U.S. EPA at: EPA Docket Center, WJC West Building, Room 3334, 1301 Constitution Avenue NW, Washington, DC 20004, www.epa.gov/dockets; (202) 202–1744. For information on the availability of this material at NARA, visit www.archives.gov/federal-register/cfr/ibr-locations or email fr.inspection@nara.gov.

² You may obtain the UL material from: Underwriters Laboratories Inc. (UL) COMM 2000; 151 Eastern Avenue; Bensenville, IL 60106; phone: 1–888–853–3503 in the U.S. or Canada (other countries +1–415–352–2168); email: orders@shopulstandards.com; website: <https://ulstandards.ul.com> or www.shopulstandards.com.

³ UL 60335–2–89, Standard for Safety for Household and Similar Electrical Appliances—Safety—Part 2–89: Particular Requirements for Commercial Refrigerating Appliances, 2nd edition, dated October 27, 2021.

⁴ You may obtain the ANSI/ASHRAE material from: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), 180 Technology Parkway NW, Peachtree Corners, Georgia 30092; phone: 1–800–527–4723 or 1–404–636–8400 in the U.S. or Canada; email: cservice@ashrae.org; website: <https://www.ashrae.org/technical-resources/bookstore/ashrae-refrigeration-resources>.

⁵ ANSI/ASHRAE Standard 15–2022. Safety Standard for Refrigeration Systems, copyright 2022.

⁶ ANSI/ASHRAE Standard 34–2022. Designation and Safety Classification of Refrigerants, copyright 2022.

⁷ ANSI/ASHRAE Addendum a to ANSI/ASHRAE Standard 34–2022, Designation and Safety Classification of Refrigerants, ANSI/ASHRAE-approved December 20, 2022.

⁸ You may obtain the UN material from the United Nations Publications section at: <https://shop.un.org/books/global-harmon-syst-class-9-92280>; by mail: United Nations Publications Customer Service, P.O. Box 960, Herndon, VA 20172; phone: 1–703–661–1571; email: order@un.org.

⁹ ST/SG/AC.10/30/Rev.9, Global Harmonized System (GHS) of Classification and Labelling of Chemicals, Ninth revised edition, copyright 2021; Chapter 2.2, Flammable Gasses, and Annex 1, Classification and Labelling Summary Tables.

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