

The EPA Administrator, Michael S. Regan, signed the following document on May 1, 2023, and the Agency is submitting it for publication in the Federal Register (FR). While we have taken steps to ensure the accuracy of this Internet version of the document, it is not the official version. Please refer to the official version in a forthcoming FR publication, which will appear on the Government Printing Office's website (<https://www.govinfo.gov>) and on Regulations.gov (<http://www.regulations.gov>) in Docket No. EPA-HQ-OAR-2023-0043. Once the official version of this document is published in the FR, this version will be removed from the Internet and replaced with a link to the official version.

6560-50-P

## **ENVIRONMENTAL PROTECTION AGENCY**

### **40 CFR Part 82**

**[EPA-HQ-OAR-2023-0043; FRL-10125-1-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:** Notice of proposed rulemaking.

**SUMMARY:** Pursuant to the U.S. Environmental Protection Agency's Significant New Alternatives Policy program, this action proposes to list certain substances in the refrigeration and air conditioning sector. Specifically, EPA proposes to list 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 proposing to incorporate 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 proposes to exempt propane, in the refrigerated food processing and dispensing end-use, from the prohibition under the Clean Air Act (CAA) on knowingly venting, releasing, or

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disposing of substitute refrigerants, on the basis of current evidence that the venting, release, or disposal of this substance in this end-use does not pose a threat to the environment.

**DATES:** Comments must be received on or before [**INSERT DATE 45 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER**]. Any party requesting a public hearing must notify the contact listed below under **FOR FURTHER INFORMATION CONTACT** by 5 p.m. Eastern Daylight Time on [**INSERT DATE 5 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER**]. If a virtual public hearing is held, it will take place on or before [**INSERT DATE 15 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER**] and further information will be provided on EPA's Stratospheric Ozone Website at <https://www.epa.gov/snap>.

**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> web site. 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 operation 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>.

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**FOR FURTHER INFORMATION CONTACT:** Gerald Wozniak, Stratospheric Protection Division, Office of Atmospheric Protection (Mail Code 6205A), Environmental Protection Agency, 1200 Pennsylvania Ave. NW, Washington, DC 20460; telephone number: 202-343-9624; email address: wozniak.gerald@epa.gov.

Notices and rulemakings under EPA’s Significant New Alternatives Policy 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 proposing 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 proposing action on these new listings in the refrigeration and air conditioning (AC) sector based on the information that EPA has included in the docket. This proposed action would provide new refrigerant options, thereby increasing flexibility for industry, in specific uses.

This action proposes to list new alternatives for the refrigeration and AC sector.

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Specifically, EPA is proposing to:

- List 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);
- List R-454A as acceptable, subject to use conditions, for use in new remote condensing units and supermarket systems;
- List R-290 (propane) as acceptable, subject to use conditions, for use in new refrigerated food processing and dispensing equipment and revise the existing use conditions for R-290 in new stand-alone units.
- List hydrofluorocarbon (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;
- Revise the existing use conditions for R-290 for use in new self-contained commercial ice machines;
- List 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 chillers for industrial process refrigeration (IPR);
- List HFC-32 and R-454B as acceptable, subject to use conditions, for use in new chillers for IPR;
- List 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

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warehouses; and

- List 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 using a remote compressor.

In general, the proposed use conditions are consistent across the various substitutes and end-uses contained in this proposal. Because of this similarity, EPA discusses the proposed use conditions that would apply to all five end-uses in section II.H. In summary, the common use conditions proposed are:

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

(2) These refrigerants may be used only in equipment that meet all requirements listed in the 2<sup>nd</sup> edition, dated October 27, 2021, of UL<sup>1</sup> 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”). For refrigerants that already have listings that incorporate by reference earlier UL standards, EPA is proposing a transition period when equipment may meet either the earlier UL standard or UL 60335-2-89.

(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.

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<sup>1</sup> UL, formerly known as Underwriters Laboratories.



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(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) These refrigerants must be used with equipment and packaging marked with the Global Harmonized System of Classification and Labelling of Chemicals (GHS) symbol for hazard category 1 flammable gases.

Additional use conditions specific to particular end-uses may also apply and are discussed with each proposed listing. The regulatory text of the proposed listings, including the proposed use conditions and further information, appears in tables at the end of this document. The proposed new listings would appear in appendix Y of 40 Code of Federal Regulations (CFR) part 82, subpart G. The proposed revised listings for R-290 in new retail food refrigeration equipment (stand-alone units only) and in new self-contained commercial ice machines would appear, respectively, in appendix R and appendix V of 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 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 260-270).

In addition, EPA is proposing to exempt R-290 used in the refrigerated food processing and dispensing end-use from the CAA section 608(c)(2) prohibition on

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knowingly venting, releasing, or disposing of substitute refrigerants on the basis of current evidence that the venting, release, or disposal of this substance in this end-use does not pose a threat to the environment.

#### *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)) 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

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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 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,

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

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

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information on the Agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the initial SNAP rulemaking published March 18, 1994 (59 FR13044), 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 refrigerants and refrigerant substitutes 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.<sup>2</sup> 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.

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<sup>2</sup> 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).

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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 and their refrigerant substitutes, which we also refer to as the “venting prohibition” in this proposed 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 issued a rule on March 12, 2004 (69 FR 11946), and a second rule on April 13, 2005 (70 FR 19273), clarifying how the venting prohibition in section 608(c) applies to substitutes for CFC and HCFC refrigerants (*e.g.*, HFCs and perfluorocarbons (PFCs)). These regulations are codified at 40 CFR part 82, subpart F. In relevant part, they provide that no person maintaining, servicing, repairing, or disposing of appliances may knowingly vent or otherwise release into the environment any refrigerant or substitute from such appliances, with the exception of 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 had also

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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).<sup>3</sup> Those regulatory exemptions do not apply to blends of HCs with other refrigerants or containing any amount of any CFC, HCFC, HFC, or PFC. The current 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.*, December 1, 2016 (81 FR 86778). 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

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<sup>3</sup> 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 proposed rule is not EPA’s response to the court’s decision.

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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 the proposed 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?*

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

*AC—Air Conditioning*

*AEL—Acceptable Exposure Limit*

*AIHA—American Industrial Hygiene Association*

*ANSI—American National Standards Institute*

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



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*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*

*CO<sub>2</sub>—Carbon Dioxide*

*DOE—United States Department of Energy*

*DOT—United States Department of Transportation*

*DX—Direct Heat Exchange*

*EPA—United States Environmental Protection Agency*

*FR—Federal Register*

*GHS—Global Harmonized System of Classification and Labelling 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*

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*ICF—ICF International, Inc.*

*IEC—International Electrotechnical Commission*

*IPCC—Intergovernmental Panel on Climate Change*

*IPR—Industrial Process Refrigeration*

*ISO—International Organisation for Standardisation*

*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*

*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*

*RCRA—Resource Conservation and Recovery Act*

*RFA—Regulatory Flexibility Act*

*SDS—Safety Data Sheet*

*SIP—State Implementation Plan*

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*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*

## **II. What is EPA proposing in this action?**

*A. Retail food refrigeration—Proposed 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 proposed listing of R-454A as acceptable, subject to use conditions, for use in new remote condensing units and supermarkets systems.*

EPA is proposing to list 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 proposing to list 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).

EPA is proposing several use conditions for these end-use categories that are

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identical to those proposed for other end-uses (commercial ice machines, IPR, cold storage warehouses, and ice skating rinks with a remote compressor) discussed elsewhere in this proposal. Because of this similarity, EPA discusses the use conditions that would apply to all five end-uses in Section II.H. In summary, the common use conditions EPA is proposing include the following: restricting the use of each refrigerant to new equipment that is specifically designed for that refrigerant; use consistent with the 2<sup>nd</sup> edition of 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.

For use of these substitutes in retail food refrigeration equipment, EPA is also proposing a use condition related to adherence to 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”). Specifically, we are proposing that these refrigerants may only be used in commercial refrigeration equipment that meets all requirements listed in ASHRAE 15-2022. In cases where the final rule includes requirements that are different than those of ASHRAE 15-2022, EPA is proposing that the appliance would need to meet the requirements of this rule in place of the requirements in ASHRAE 15-2022. This additional use condition is discussed further in Section II.A.4.

EPA is also proposing the following use condition for R-454A in supermarkets and remote condensing units: 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.

### *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 comparisons of the overall impact on human health and the environment and of the availability of 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 refrigeration circuit is entirely brazed or welded. These systems are charged with refrigerant at the factory and typically require only an electricity supply to begin operation. Such systems are used to chill and temporarily store perishable items for commercial sale, such as beverages and food.

Refrigerated food processing and dispensing equipment dispenses and often processes a variety of food and beverage products. For instance, some such equipment will process the product by combining ingredients, mixing, and preparing it at the proper temperature, while others function mainly as a holding tank to deliver the product at the desired temperature or to deliver chilled ingredients for processing, mixing, and

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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 include but are 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 exhibit refrigerating capacities ranging typically 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 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 plurality of supermarkets in the

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United States use centralized direct expansion (DX) systems to cool their display cases.<sup>4</sup>

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 chiller 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, air, HCs, ammonia, and carbon dioxide (CO<sub>2</sub>). 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-

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<sup>4</sup> [www.epa.gov/greenchill/advanced-refrigeration](http://www.epa.gov/greenchill/advanced-refrigeration)

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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 CO<sub>2</sub> (R-744), in the low-temperature system, with a variety of refrigerants in the high temperature system.

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 (R-717). Building codes from local and state agencies may also incorporate limits on the types and amounts of particular refrigerants used. There are and will continue to be multiple factors that retailers must consider when selecting the refrigerant and operating system design, including: energy efficiency; system performance; potential impact on community safety; ambient temperatures; risk to personnel safety; cost; and minimization of direct and indirect environmental impacts.

## *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.



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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).<sup>5</sup> 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/m<sup>3</sup>. 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/m<sup>3</sup>, 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/m<sup>3</sup> or lower.

For flammability classifications, refrigerant blends are designated based on the

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<sup>5</sup> ASHRAE, 2022b. ANSI/ASHRAE Standard 34-2022: Designation and Safety Classification of Refrigerants.

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worst case of formulation for flammability and the worst case of fractionation for flammability determined for the blend.

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-454B, R-454C, R-455A, R-457A, and R-516A, which are discussed in this section of this proposed 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 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.<sup>6</sup> The respective Chemical Abstracts

<sup>6</sup> 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 (HPs) (86 FR

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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<sup>®</sup> yf” and “Opteon<sup>™</sup> 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<sup>®</sup> ze and Solstice<sup>®</sup> 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<sup>®</sup> 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<sup>®</sup> 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<sup>®</sup> L40X,” is a blend consisting of 21.5 percent HFC-32, 75.5 percent HFO-1234yf, and three percent R-744 (CO<sub>2</sub>). R-454A, also known by the trade name “Opteon<sup>™</sup> 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<sup>™</sup> 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 proposed 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 substitutes. These risk screens are available in the docket for this proposed

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24444, May 6, 2021).

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rule. <sup>7</sup> <sup>8</sup> <sup>9</sup> <sup>10</sup> <sup>11</sup> <sup>12</sup> <sup>13</sup>

*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 has a GWP of less than four.<sup>14</sup><sup>15</sup> <sup>16</sup> HFO-1234ze(E) has a GWP of less than six.<sup>17</sup> <sup>18</sup> The refrigerant blends are made up of the components HFC-32, HFC-125, HFC-152a, CO<sub>2</sub>, and HFO-1234yf, which have GWPs of 675, 3,500, 124, one, and less than four, respectively.<sup>19</sup> If these values are weighted by mass percentage, then R-

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<sup>7</sup> ICF, 2023a. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: HFO-1234yf.

<sup>8</sup> ICF, 2023b. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: HFO-1234ze(E) (Solstice® ze, Solstice® 1234ze)

<sup>9</sup> ICF, 2023c. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: R-454A (Opteon® XL40).

<sup>10</sup> ICF, 2023d. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: R-454C (Opteon™ XL20).

<sup>11</sup> ICF, 2023e. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: R-455A (Solstice® L40X).

<sup>12</sup> ICF, 2023f. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: R-457A (Forane® 457A).

<sup>13</sup> ICF, 2023g. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: R-516A (Forane® 516A).

<sup>14</sup> World Meteorological Organization (2018). Burkholder *et al.* Appendix A, Table A-1 in *Scientific Assessment of Ozone Depletion: 2018, Global Ozone Research and Monitoring Project*, Report No. 58, World Meteorological Organization, Geneva, Switzerland, <https://ozone.unep.org/science/assessment/sap>. (WMO, 2018)

<sup>15</sup> Nielsen *et al.*, 2007. Nielsen, O.J., Javadi, M.S., Sulbaek Andersen, M.P., Hurley, M.D., Wallington, T.J., Singh, R. 2007. Atmospheric chemistry of CF<sub>3</sub>CF=CH<sub>2</sub>: Kinetics and mechanisms of gas-phase reactions with Cl atoms, OH radicals, and O<sub>3</sub>. *Chemical Physics Letters* 439, 18–22. Available online at: [www.cogci.dk/network/OJN\\_174\\_CF3CF=CH2.pdf](http://www.cogci.dk/network/OJN_174_CF3CF=CH2.pdf).

<sup>16</sup> Hodnebrog Ø. *et al.*, 2013. Hodnebrog Ø., Etminan, M., Fuglestedt, 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

<sup>17</sup> Javadi *et al.*, 2008. Atmospheric chemistry of trans-CF<sub>3</sub>CH=CHF: products and mechanisms of hydroxyl radical and chlorine atom initiated oxidation, M.S. Javadi, R. Søndergaard, O.J. Nielsen, M.D. Hurley, and T.J. Wallington, *Atmospheric Chemistry and Physics Discussions* 8, 1069–1088, 2008.

<sup>18</sup> *Ibid.*

<sup>19</sup> 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

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454A, R-454C, R-455A, R-457A, and R-516A have GWPs of about 240, 150, 146, 140, and 142, respectively.

HFO-1234yf, HFO-1234ze(E), and the other components of the refrigerant blends, CO<sub>2</sub>, HFC-32, HFC-125, and HFC-152a, are excluded from EPA's regulatory definition of volatile organic 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."

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 industrial process refrigeration, 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 industrial process refrigeration) 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 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

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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.

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classification of 2L.

*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 substitutes include drowsiness or dizziness. The substitutes may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitutes may cause irregular heartbeat. The substitutes 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 CO<sub>2</sub> 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; 500 ppm as an 8-hr TWA for HFO-1234yf; and 800 ppm as an 8-hr TWA for HFO-1234ze(E). 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.<sup>20</sup> 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 use conditions proposed (including adherence to Underwriters Laboratories (UL) 60335-2-89 and ASHRAE 15-2022), and other safety precautions common to the refrigeration and AC industry.

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<sup>20</sup> The 8-hr TWA AEL recommendations of these refrigerant blends are based upon a mass-weighting of the PEL and WEELs of their components.

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*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 CO<sub>2</sub>, with an ODP of zero.

For new refrigerated food processing and dispensing equipment, R-454A, R-454C, R-455A, R-457A, and R-516A have GWPs ranging from 140 to 240, higher than to that of CO<sub>2</sub>, an acceptable substitute in this end-use category, with a GWP of 1, while HFO-1234yf and HFO-1234ze(E) have comparable GWPs to CO<sub>2</sub> of less than four and less than six, respectively. The GWPs of HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A are lower than those of other acceptable substitutes for new refrigerated food processing and dispensing equipment, such as R-450A, R-513A, and 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 240, higher than that of ammonia and CO<sub>2</sub>, 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 CO<sub>2</sub> of less than four and less than six, respectively. 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 600, 630, 1,430, 2,110, and 2,630, respectively.

For new stand-alone units, R-454A, R-454C, R-455A, R-457A, and R-516A have GWPs ranging from 140 to 240, higher than some of the acceptable substitutes in this

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end-use category such as CO<sub>2</sub>, 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 GWPs of CO<sub>2</sub>, R-290, and R-441A of less than four and less than six, respectively. 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.

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 above. 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 proposed refrigerants can be minimized by use consistent with UL 60335-2-89 – which would be required by our proposed use conditions – and other industry standards, such as ASHRAE 15-2022—which applies under the use conditions—as well as 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 these end-uses, determined by the likelihood of exceeding their respective lower flammability limits, are evaluated in the risk screens referenced above. In conclusion, while these refrigerants may pose greater flammability risk than



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other available substitutes in the same end-uses, this risk can be minimized by use consistent with ASHRAE 15-2022, which would be required for equipment with certain charge sizes by our proposed use conditions, and other industry standards such as UL 60335-2-89, which would also be required by our proposed use conditions, as well as recommendations in the manufacturers' SDS and other safety precautions common in the refrigeration and AC industry. EPA is proposing use conditions that maintain the low potential risk associated with the flammability of these alternatives so that they will not pose significantly greater risk than other acceptable substitutes in this end-use category.

In addition, the proposed substitutes have lower GWPs than most other available alternatives for the same uses. The proposed refrigerants provide 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, or where equipment using CO<sub>2</sub> may not be able to meet energy conservation standards from the U.S. Department of Energy (DOE). 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. To provide additional options to ensure the availability of substitutes for the full range of retail food refrigeration equipment with lower GWP and, therefore, lower overall risk to human health and the environment, EPA is proposing the listings for 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 additional challenges for finding lower GWP refrigerants with higher

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capacity for remote condensing units and supermarket systems with moderate charge sizes and for cascade systems, EPA is proposing to list 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 proposing these specific use conditions?*

This proposal 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. In addition, ASHRAE 15-2022 applies to these refrigeration systems.

The standard UL 60335-2-89 discussed in section II.H indicates that refrigerant charges greater than a specific amount (called “m<sub>3</sub>” in the standard and based on the refrigerant’s LFL) are beyond its scope and that national standards might apply, such as ASHRAE 15-2022. Hence, EPA is proposing to require adherence to both standards as use conditions for remote condensing units and supermarket systems, broadening the coverage under this proposed rule.

EPA is proposing to incorporate by reference ASHRAE 15-2022, including all addenda published by the date of this proposal, in use conditions that apply to use of the proposed A2L refrigerants in new remote condensing units and supermarket systems. Where the requirements specified in this proposed rule (if finalized) and ASHRAE 15-2022 differ, the requirements of this rule would apply.

A partial summary of ASHRAE 15-2022 is provided here for information only.

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This is not meant to be a full explanation of the standard or how it is applied. ASHRAE 15-2022 specifies requirements for refrigeration systems, based on the safety group classification of the refrigerant used, the type of occupancy in the location for which the system is used, and whether refrigerant-containing parts of the system enter the space or ductwork and so leakage in the space is deemed “probable.” “High-probability” installations are those such that leaks or failures will result in refrigerant entering occupied space. As previously explained, HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A are all classified as A2L refrigerants. 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 in this proposal when used in “high-probability” systems that are not for human comfort, including requirements for nameplates, labels, refrigerant detectors (under certain conditions), airflow initiation and other actions (if a rise in refrigerant concentration is detected), and other restrictions.

EPA recognizes that ASHRAE 15-2022 is undergoing continuous maintenance with publication of periodic addenda and is typically updated and republished every three years. While this proposed rule incorporates all addenda published by the date of this proposal, there may be additional changes to ASHRAE 15-2022 by the time EPA issues a

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final rule based upon this proposal. However, given EPA would not have reviewed and proposed use conditions based on those changes, EPA is not proposing to include addenda or other changes made to ASHRAE 15-2022 after the date of the proposed rule.

EPA is proposing to list R-454A as acceptable, subject to use conditions, in supermarkets and remote condensing units with a use condition 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 proposing this use condition to allow use of R-454A less broadly than for the other refrigerants proposed for use in remote condensing units and supermarket systems because its GWP is higher than those of the other proposed listings for these end-use categories (about 240, compared to less than four to 150). EPA's understanding is that there are two particular situations where use of refrigerants is likely to be more constrained, and thus, additional refrigerant options 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 200 pounds 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 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, such as where charge sizes of 200 pounds or more of A2L refrigerant would be allowed under the use conditions

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incorporating UL 60335-2-89 and ASHRAE 15-2022, there would be fewer space constraints and greater flexibility in equipment design, so refrigeration system designers can accommodate a narrower set of substitutes. Conversely, where the general public is more likely to come into contact with any leaked refrigerant in an interior space, refrigerant charge capacities of a system would be less than 200 pounds; there would be more space constraints, less flexibility in equipment design, and potentially stricter code requirements, leading to a need for more refrigerant options. Allowing the additional option of R-424A for supermarket systems and remote condensing units with smaller refrigerant charges would enable the use of a wider set of available substitutes to manage safety (in particular, flammability and toxicity), as well as allowing more options to achieve adequate performance where there may be more constraints. Therefore, EPA is proposing to list R-454A as acceptable, subject to use conditions, only for supermarket systems and remote condensing units with a refrigerant charge capacity less than 200 pounds.

EPA is also proposing to list R-454A as acceptable, subject to use conditions, for use in the high temperature side of cascade systems used for supermarket systems and remote condensing units. As discussed above in section II.A.1, “Background on retail food refrigeration,” each system 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, low boiling refrigerants such as R-744 can be used. Considerations for

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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 for 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 standards). The Agency considered whether to propose to list R-454A as acceptable, subject to narrowed use limits. For listings with narrowed use limits, the refrigerant user (*e.g.*, equipment manufacturer or end user) intending to adopt a substitute with narrowed use limits "must ascertain that other alternatives are not technically feasible." 40 CFR 82.180(b)(3). In the case of the high side of a cascade system, EPA is currently aware of a limited number of available options with a GWP below R-454A; therefore, EPA does not consider it necessary to require users to first consider those lower GWP refrigerants before selecting R-454A. The Agency notes that there are multiple substitutes available for the low temperature side of the cascade system with GWPs lower than that of R-454A, but there are few options for the high temperature side of the cascade system. Therefore, instead of proposing to list R-454A as acceptable, subject to narrowed use limits and subject to use conditions, EPA is proposing to list 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.

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

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EPA is providing additional information related to these proposed 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. The additional information applies to multiple end-uses covered in this proposal. Because of this similarity, EPA discusses the proposed additional information in these proposed listings that would apply to all five end-uses in section II.H.2. 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.

*6. On which topics is EPA specifically requesting comment?*

EPA is requesting comment on all aspects of the proposed decision to list HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A acceptable, subject to use conditions, in new supermarket systems and new remote condensing units as discussed in this section II.A. We also request comment on the use conditions specifically for R-454A, restricting its use to supermarket systems and remote condensing units used either with a refrigerant charge capacity of less than 200 pounds or in the high temperature side of a cascade system, and whether EPA should use different criteria in the final use conditions. We request comment on our proposal to find HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A acceptable, subject to use conditions, for use in new refrigerated food processing and dispensing equipment (self-contained equipment) and new stand-alone units. EPA also seeks specific comments on the use conditions including the proposed requirements to comply with UL 60335-2-89, and for charge sizes larger than “m<sub>3</sub>,” also to comply with ASHRAE 15-2022 including addenda as of the date of this proposal. With respect to these standards, EPA is requesting

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comment on the risk mitigation offered by compliance with the current version of the standards proposed as use conditions, *i.e.*, UL 60335-2-89 and ASHRAE 15-2022, the nature of updates proposed for these standards, and the expected timeline for those updates. EPA is requesting comment on the applicability of the 2<sup>nd</sup> edition of UL 60335-2-89 to retail food refrigeration equipment, including which types of equipment and under which applications the standard applies, as well as on the applicability of ASHRAE 15-2022 with the addenda published as of the date of this proposal. Finally, EPA requests comment on whether there are any specific cases of conflicts between UL 60335-2-89 and ASHRAE 15-2022 that require a clarification as to which standard should apply.

*B. Retail food refrigeration—Proposed listing of R-290 as acceptable, subject to use conditions, for use in new refrigerated food processing and dispensing equipment and proposed revision of use conditions provided in the previous listing of R-290 as acceptable, subject to use conditions, for use in stand-alone units.*

This proposed listing for R-290 would be a new listing for one end-use category under retail food refrigeration, *i.e.*, *new refrigerated food processing and dispensing equipment*. Further, EPA is also proposing to revise use conditions provided in the previous 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). Today we are proposing to update those use conditions to be consistent with the most recent U.S. national standard for retail food refrigeration equipment, the 2<sup>nd</sup> edition of UL 60335-2-89. Similar use conditions apply to other refrigerants with lower flammability as proposed in this SNAP action in section II.A above. The proposed use



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conditions would be allowed for such equipment manufactured on or after the effective date of any final rule and would not apply to nor affect equipment manufactured before the effective date of any final action and manufactured in compliance with the SNAP requirements applicable at the time of manufacture.

This proposed revision to the use conditions would incorporate by reference a different industry standard, changing the reference from Supplement SB to the 10<sup>th</sup> edition of UL 471, “Commercial Refrigerators and Freezers,” which is required in the current SNAP listing for R-290, to the 2<sup>nd</sup> edition of UL 60335-2-89. EPA is proposing a transition period during which stand-alone units manufactured with R-290 may follow either the earlier standard UL 471 or UL 60335-2-89. After the transition period ends, stand-alone units manufactured with R-290 would need to follow UL 60335-2-89 for purposes of the SNAP program.

Several use conditions proposed for these end-use categories are similar to those proposed for other end-uses. Because of this similarity, EPA discusses the use conditions that would apply to all five end-uses in section II.H. In summary, the common use conditions proposed include the following: restricting the use of each refrigerant to new equipment that is specifically designed for that refrigerant; use consistent with the 2<sup>nd</sup> edition of 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.

If the regulatory text is finalized as proposed, EPA would revise the existing listing for R-290 in new stand-alone units in appendix R of 40 CFR part 82, subpart G

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and would add the new listing for R-290 in refrigerated food processing and dispensing units in appendix Y of 40 CFR part 82, subpart G. The proposed 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 proposing substantive changes to, and is not taking comment on, 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 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 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 also known as propane and has the formula C<sub>3</sub>H<sub>8</sub> (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 proposed 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 substitute. This risk screen is available

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in the docket for this proposed rule.<sup>21</sup>

*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 prohibition under CAA section 608(c)(2) on knowingly venting, releasing, or disposing of substitute refrigerants, 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 (propane) 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 below, EPA estimates that potential emissions of saturated HC refrigerants, such as R-290 and R-600a (isobutane), do not have a significant impact on local air quality.<sup>22</sup>

EPA has conducted multiple analyses of various scenarios to consider the potential impacts on local air quality if HC refrigerants were used widely.<sup>23</sup> 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

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<sup>21</sup> ICF, 2023h. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment); Substitute: Propane (R-290).

<sup>22</sup> ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February, 2014.

<sup>23</sup> Ibid.

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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 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 1% 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 significantly greater risk to the environment than other alternatives. Using the current ozone NAAQS value of 70 ppb, use of the most reactive saturated HC, R-600a, with a 100% market penetration would just exceed a level that might raise concerns for EPA. However, considering that R-290 is less reactive than R-600a<sup>24</sup> and that R-290 would have a market penetration at least as high as that of R-600a,<sup>25</sup> we still consider use of saturated HC refrigerants not to result in significantly greater risk.

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 proposed to be acceptable under this rule. For example, we assumed use of R-290 in refrigerated food processing and dispensing equipment<sup>25</sup> and in end-uses

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<sup>24</sup> R-600a has a maximum incremental reactivity (MIR) of 1.34 g O<sub>3</sub>/g R-600a, while R-290 has a MIR of 0.56 g O<sub>3</sub>/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.

<sup>25</sup> 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.

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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.<sup>26</sup> Based on this still conservative but more probable assessment of refrigerant use, we found that even if all the refrigerant in appliances in end-uses addressed in this proposed rule and in appliances in end-uses for which 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. 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).<sup>27</sup> 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 refrigerants that have been listed acceptable more recently (*e.g.*, R-1150 in very low temperature refrigeration) and using updated models.<sup>28</sup> EPA found that the

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

<sup>27</sup> Ibid.

<sup>28</sup> ICF, 2020. 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, 2020.

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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 proposed use conditions in this rule, would not result in significantly greater risk to people's health or the environment than other alternatives available for the same end-use, refrigerated food processing and dispensing equipment.

Based on the results of these analyses, EPA is proposing to list R-290 as acceptable, subject to use conditions, in 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 proposed refrigerated processing and dispensing equipment end-use category, even in a worst-case scenario, we conclude that R-290 does not have a significantly greater overall impact on human health and the environment based on its effects on local air quality than other refrigerants listed as acceptable in the same end-uses.

*Flammability information:* R-290 is a higher flammability refrigerant, with an ASHRAE safety classification of A3. However, the proposed substitute is not expected to present a flammability concern provided the proposed use conditions are followed.

*Toxicity and exposure data:* R-290 has an ASHRAE toxicity classification of A

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(lower toxicity). Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. This substitute 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 propane (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 use conditions proposed (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 CO<sub>2</sub>, R-450A, and R-513A, with ODPs of zero.

R-290's GWP of 3 is comparable to that of other acceptable substitutes for new refrigerated food processing and dispensing equipment, including CO<sub>2</sub>, with a GWP of 1. 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,<sup>29</sup> including refrigerated food processing and dispensing equipment, found that R-290 can be used without

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<sup>29</sup> ICF, 2023h. Op. cit.

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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 we noted that the flammability of R-290 may be greater than that of other available, substitutes with an ASHRAE 1, 2, or 2L flammability classification in the same end-use, we found its flammability risk to be not significant even under worst-case assumptions in this end-use category when following the proposed use conditions.<sup>30</sup> We note that flammability risk can be minimized by use consistent with industry standards such as UL 60335-2-89 – which would be required by our proposed use conditions – and ASHRAE 15-2022, as well as recommendations in the manufacturers’ SDS and other safety precautions common in the refrigeration and air conditioning industry. The proposed use conditions for refrigerated food processing and dispensing equipment would maintain low potential risk associated with the flammability of this alternative so that it will not pose significantly greater risk than other acceptable substitutes in this end-use category.

The proposed substitute, R-290, has a GWP of 3, 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 CO<sub>2</sub> may not be able to meet DOE’s energy conservation standards. To provide additional, lower-GWP options with

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<sup>30</sup> ICF, 2023h. Op. cit.



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lower overall risk to human health and the environment, EPA is proposing the listing of R-290 as acceptable, subject to use conditions, for use in refrigerated food processing and dispensing equipment.

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

For refrigerated food processing and dispensing equipment, EPA proposes to require use of UL 60335-2-89, for purposes of the SNAP program, as of the effective date of the final rule based on this proposal. Several of the use conditions proposed for refrigerated food processing and dispensing equipment are common to those proposed for R-290 in the commercial ice machine end-use in section II.D, and others are common to all five end-uses in this proposed rule. Because of this similarity, EPA discusses the use conditions that would apply to all five end-uses in section II.H. In summary, the common use conditions proposed include the following: restricting the use of each refrigerant to new equipment that is specifically designed for that refrigerant; use consistent with the 2<sup>nd</sup> edition of 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.

*5. How would the proposed 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 document, EPA is proposing to exempt R-290 used as a refrigerant in refrigerated food processing and dispensing equipment from the prohibition

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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 industrial process refrigeration.

*6. What use conditions currently 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 of 40 CFR part 82, subpart G. EPA provided information on the potential environmental and health risks of R-290 and the various substitutes available at that time for use in this end-use category. Additionally, 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 2011 listing 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 the standard 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

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flammability hazards. EPA explained in that rulemaking that without appropriate use 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 significantly 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 proposing?*

EPA is proposing to update the use conditions that apply to R-290 in new stand-alone units manufactured on or after the effective date of any final rule based on this proposal. Several of the updated use conditions proposed for use of R-290 in stand-alone units are common to those proposed for the commercial ice machine end-use in section II.D, and others are common to all five end-uses in this proposed rule. Because of this similarity, EPA discusses the use conditions that would apply to all five end-uses in section II.H. For R-290 in stand-alone units, these are the only revised use conditions EPA is proposing. In summary, with the updates proposed to the use conditions for stand-alone units, the common use conditions proposed include the following: restricting the use of each refrigerant to new equipment that is specifically designed for that refrigerant; use consistent with the 2<sup>nd</sup> edition of UL 60335-2-89, including testing, charge sizes, ventilation, usage space requirements, and certain hazard warnings and markings; and

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

If finalized as proposed, the use conditions in this action would apply to new stand-alone units on or after the effective date of any final rule. Any final rule would not apply to nor affect equipment manufactured before the effective date of this action and manufactured in compliance with the SNAP use conditions applicable at the time of manufacture as stipulated in SNAP Rule 17 and appendix R of 40 CFR part 82, subpart G. 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. If this rule is finalized as proposed, new stand-alone units manufactured between February 21, 2012, and the effective date of the final rule would be required to meet the use conditions in SNAP Rule 17 (which took effect February 21, 2012) and as listed in appendix R of 40 CFR part 82, subpart G, including the use condition incorporating by reference Supplement SB to the 10<sup>th</sup> edition of UL 471. Such products would be permitted to be warehoused and sold through normal channels, even if they are sold or installed after the effective date of any final rule based on this proposed rule. Stand-alone units using R-290 manufactured on or after the effective date of any final rule based on this proposal would be required to meet the use conditions so finalized and listed in the revisions to appendix R. Those use conditions would 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 any final rule based on this proposal and would last through September

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29, 2024. On and after September 30, 2024, the use condition for use of R-290 in equipment that meets UL 60335-2-89 only would apply under SNAP.

EPA is proposing use conditions allowing new stand-alone units to be manufactured consistent with Supplement SB of UL 471, up to and including September 29, 2024, which is the date when UL is sunsetting UL 471. Therefore, during the time between the effective date of any final rule based on this proposal and September 29, 2024, manufacturers would be allowed to follow either UL 471, 10<sup>th</sup> Edition or UL 60335-2-89, 2<sup>nd</sup> Edition. EPA is proposing 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. EPA proposes that, beginning September 30, 2024, R-290 may only be used in new stand-alone units that meet all requirements in UL 60335-2-89 for the purposes of the SNAP program. See section II.H.1 for further discussion on the requirements of this standard that EPA is proposing to incorporate by reference.

In addition, we are proposing that manufacturers would need to 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 2 and when using UL 60335-2-89, follow all use conditions in listing 4 in the proposed revisions to appendix R). After the transition period ends, stand-alone units manufactured with R-290 would need to follow UL 60335-2-89 for purposes of the SNAP program.

EPA also notes that we are not proposing to change two use conditions that

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currently apply, nor are we taking comment on those other 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 on service ports, pipes, hoses, and other devices through which the refrigerant is serviced, repeat the current use conditions for R-290 in new stand-alone units. If the regulatory text is finalized as proposed, EPA would amend to add use conditions that apply to R-290 in new stand-alone units manufactured on or after the effective date of the final rule. Equipment manufactured before the effective date of the final rule would not be affected by this action and would hence be subject to the current use conditions included in appendix R.

*8. How do the proposed use conditions for stand-alone units differ from the existing ones and why is EPA proposing to change the use conditions?*

The revised use conditions EPA is proposing for stand-alone units are similar to the ones that exist today in appendix R of 40 CFR part 82 subpart G for R-290 in this end-use category. The 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 proposed listing. The updated use conditions concern incorporating by reference the most recent U.S. national standard and updated labeling requirements consistent with that new standard. Stand-alone units using R-290 manufactured before the effective date of a final rule to this proposal would not be affected by the updated use conditions.

Warning labels are required under EPA's current regulations, and EPA is proposing to continue to require them, although with some specific language changes. The proposed warning labels are similar to those required currently as use conditions for

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the use of R-290 in stand-alone units. EPA finds that using a common set of labels, similar to those from UL 60335-2-89, would aid in compliance and could reduce burden for the industry, especially for a manufacturer that uses more than one refrigerant. EPA is proposing 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 current requirement for R-290 in stand-alone units.

EPA is proposing to incorporate by reference a new industry standard in the use conditions, including use of the 2<sup>nd</sup> edition of UL 60335-2-89 instead of continuing to require the standard Supplement SB of the 10<sup>th</sup> edition of UL 471 for equipment manufactured on or after the effective date of any final rule based on this proposal. 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 2<sup>nd</sup> edition, including final recirculation, concluded with its publication on October 27, 2021. The 2<sup>nd</sup> edition of UL 60335-2-89 replaces the previously published version of several standards, including UL 471, which had already been published as a 10<sup>th</sup> edition by that time. EPA was aware of the continuing progress of UL standards to address flammable refrigerants more appropriately. 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 (HPs) 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.”

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Today, we are proposing such a change knowing that UL is replacing the standard to which such equipment is certified from UL 471 to the newer standard UL 60335-2-89 starting September 30, 2024.

To allow time for manufacturers of stand-alone units to transition between the current use condition using the 10<sup>th</sup> edition of UL 471, and the new use condition using the 2<sup>nd</sup> edition of UL 60335-2-89, EPA is proposing to allow R-290 to be used in stand-alone units manufactured either following UL 471 or UL 60335-2-89 during a transition period. We propose that transition period would begin on the effective date of the final rule based on this proposal and would last through September 29, 2024. It is EPA's understanding that UL intends to sunset UL 471 on September 29, 2024, and EPA is proposing to coordinate with that sunset date. Beginning September 30, 2024, the use condition in effect would only allow R-290 to be used in new stand-alone units that follow UL 60335-2-89. In addition, we are proposing that manufacturers would need to 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 proposed revisions to appendix R).

Updating the UL standard incorporated as a use condition will provide more consistency amongst the products within the retail food refrigeration end-use. This change will allow the industry to focus on the most recent standard. The change will be helpful in implementing any transitions needed or planned for manufacturers, installers, and technicians. A manufacturer, who may offer different products within this end-use with different refrigerants, could use similar processes, such as in developing and applying the warning labels required. Installers and technicians, likewise, would not need



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to reference different standards depending on the type of equipment and the particular flammable refrigerant being used in that equipment, when putting in a new piece of equipment or servicing that equipment.

Another proposed revision to the use conditions is the limit on charge sizes. The current use conditions from SNAP Rule 17 require the charge sizes calculated consistent with UL 471, with a maximum charge of 150 g allowed. The proposed revised use conditions for equipment manufactured on or after the effective date of any final rule would allow charge sizes calculated based on UL 60335-2-89, which allows charges of up to 500 g of R-290 for open stand-alone units, or 300 g for those with doors and drawers.

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.<sup>31</sup> In this risk screen, EPA adjusted charge sizes to be consistent with the larger charge sizes of 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. The updated risk screen found that concentrations of R-290 still would not exceed the LFL when used according to the proposed use condition and consistent with UL 60335-2-89, and thus the proposed new use conditions would also address potential flammability risks of using R-290.<sup>32</sup> In addition, the risk screen modeled the reasonable work case scenario of short-term exposure (15-minute TWA) due to a catastrophic release of the charge. Under this

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<sup>31</sup> ICF, 2023h. Op. cit.

<sup>32</sup> Ibid.

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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.<sup>33</sup> For further information, see the risk screen in the docket for this rulemaking.

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

EPA is providing additional information related to the proposed listing for R-290 in new refrigerated food processing and dispensing equipment and the proposed revised 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 substitute under the SNAP program. See section II.H.2 for further discussion on what additional information EPA is including in these proposed listings. EPA notes that the 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. EPA is proposing additional information consistent with that included in the other proposed listings for 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. 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.

*10. On which topics is EPA specifically requesting comment?*

EPA is requesting comment on all aspects of the proposed decision to list R-290 acceptable, subject to use conditions, in new refrigerated food processing and dispensing

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<sup>33</sup> The source of the ATEL is ASHRAE 34-2022, as cited in ICF, 2023h. Op cit.

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equipment as discussed in this section II.B. EPA also requests comments on the proposed change in use conditions for use of R-290 in stand-alone units, and if and how such change would affect the safety of stand-alone units using R-290. The Agency requests comment on the time periods during which manufacturers are to follow UL 471, either UL 471 or UL 60335-3-89, or only UL 60335-2-89. EPA also requests comments on the proposed use conditions for use of R-290 in new refrigerated food processing and dispensing equipment, including the proposed requirements to comply with UL 60335-2-89. With respect to this standard, EPA is requesting comment on the risk mitigation offered by compliance with the current version of the standard proposed as use conditions, *i.e.*, UL 60335-2-89, the nature of updates proposed for this standard, and the expected timeline for those updates. EPA is requesting comment on the applicability of the 2<sup>nd</sup> edition of UL 60335-2-89 to refrigerated food processing and dispensing equipment, including which types of equipment, under which applications the standard applies, and whether the listing of R-290 should apply to refrigerated food processing and dispensing equipment that has a remote compressor and is not self-contained.

*C. Commercial Ice Machines—Proposed 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.*

EPA is proposing to list 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.

Several use conditions proposed for commercial ice machines are common to those proposed for other end-uses. Because of this similarity, EPA discusses the use

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conditions that would apply to all five end-uses in section II.H. For commercial ice machines, those are the only use conditions EPA is proposing. In summary, the common use conditions proposed include the following: restricting the use of each refrigerant to new equipment that is specifically designed for that refrigerant; use consistent with the 2<sup>nd</sup> edition of 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.

If the regulatory text is finalized as proposed, EPA would revise the existing listing for R-290 in new self-contained commercial ice machines in appendix V of 40 CFR part 82, subpart G. The proposed 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 proposing substantive changes to, and is not taking comment on, those earlier decisions (*i.e.*, 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 machines<sup>34</sup> 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

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<sup>34</sup> 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.

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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 equipment). 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.”

Today’s proposal, if finalized, would list HFC-32, HFO-1234yf, R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, in new commercial ice machines.

*2. What are the ASHRAE classifications for refrigerant flammability?*

ASHRAE 34-2022 categorizes the refrigerants proposed for commercial ice machines in this section as being in the A2L Safety Group. See section II.A.2 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 for further discussion on the environmental, flammability, toxicity, and exposure information for HFC-32, HFO-1234yf, R-454A, R-454B, R-454C,

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R-455A, R-457A, and R-516A.<sup>35</sup>

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 proposed 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 substitutes. These risk screens are available in the docket for this proposed rule.<sup>36 37 38 39 40 41 42 43</sup>

*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

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<sup>35</sup> 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 HPs (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.

<sup>36</sup> ICF, 2023i. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: HFC-32.

<sup>37</sup> ICF, 2023j. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: HFO-1234yf.

<sup>38</sup> ICF, 2023k. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-454A (Opteon® XL40).

<sup>39</sup> ICF, 2023l. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-454B.

<sup>40</sup> ICF, 2023m. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-454C (Opteon™ XL20).

<sup>41</sup> ICF, 2023n. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-455A (Solstice® L40X).

<sup>42</sup> ICF, 2023o. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-457A (Forane® 457A).

<sup>43</sup> ICF, 2023p. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-516A (Forane® 516A).

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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 less than four, comparable to that of R-290 and ammonia with GWPs of 3 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 commercial ice machines, including R-290 and ammonia with GWPs of 3 and zero, respectively, 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 such systems. Our initial evaluation is that the characteristics of HFC-32 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 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

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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 proposed refrigerants can be mitigated by use consistent with UL 60335-2-89, 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 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 lower flammability limits, are evaluated in the risk screens referenced previously in this section. While these refrigerants may 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 by our proposed use conditions, as well as recommendations in the manufacturers' SDS and other safety precautions common in the refrigeration and AC industry. EPA is proposing use conditions to reduce the potential risk associated with the flammability of these alternatives so that they will not pose significantly greater risk than other acceptable substitutes in the new commercial ice machines end-use.

In addition, the proposed substitutes have lower GWPs than most other available alternatives for new commercial ice machines. The proposed refrigerants provide 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 CO<sub>2</sub> may not be able to meet energy



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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 substitutes with lower GWP for the full range of new commercial ice machines and, therefore, lower overall risk to human health and the environment, EPA is proposing the listings for 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.

*4. Why is EPA proposing these specific use conditions?*

EPA is proposing to list 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 use conditions identified in these proposed listings are explained in section II.H.1 in greater detail.

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

EPA is providing additional information related to these proposed 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. See section II.H.2 for further discussion on what additional information EPA is including in these proposed listings. While the items listed are not legally binding under the SNAP program, EPA encourages users of substitutes to apply all statements in the “Further

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Information” column in their use of these substitutes.

*6. On which topics is EPA specifically requesting comment?*

EPA is requesting comment on all aspects of the proposed decision to list HFC-32, HFO-1234yf, and R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A acceptable, subject to use conditions, in new commercial ice machines as discussed in this section II.C. EPA seeks comment on the risk mitigation offered by the proposed use conditions, including requiring compliance with UL 60335-2-89, except to the extent the proposed rule conflicts with the UL Standard, in which case we propose that the use conditions specified in the rule would apply. We also request comment on whether EPA should consider other use conditions to further mitigate potential risk from the proposed refrigerants in this end-use. EPA requests comment on whether commercial ice machines have been designed for or manufactured with the refrigerants proposed and any information on the safety of such equipment in other countries, and if and how such experience would translate to safe use in the United States.

*D. Commercial Ice Machines—Proposed revision of 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 proposing to revise use conditions in the previous listing of R-290 as acceptable, subject to use conditions, for use in new self-contained commercial ice machines. More specifically, EPA previously listed R-290 as acceptable, subject to use conditions, in new self-contained commercial ice machines in SNAP Rule 21 (81 FR 86779, December 1, 2016). Today we are proposing to update those use conditions to be consistent with the most recent U.S. national standard for commercial refrigeration

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equipment, including commercial ice machines, the 2<sup>nd</sup> edition of UL 60335-2-89.

Similar use conditions would apply to other refrigerants with lower flammability as proposed in this SNAP action in section II.C above. The proposed revised use conditions would be allowed for such equipment manufactured on or after the effective date of any final rule and would not apply to nor affect equipment manufactured before the effective date of any final action and manufactured in compliance with the SNAP requirements applicable at the time of manufacture.

This proposed revision to the use conditions would incorporate by reference a different industry standard, changing the reference from Supplement SA to the 8<sup>th</sup> edition, dated July 31, 2009, of the standard UL 563, “Ice Makers” to the 2<sup>nd</sup> edition of UL 60335-2-89. EPA is proposing a transition period during which self-contained commercial ice machines manufactured with R-290 may follow either the earlier standard UL 563 or UL 60335-2-89. After the transition period ends, self-contained commercial ice machines manufactured with R-290 would need to follow UL 60335-2-89 for purposes of the SNAP program.

Several use conditions proposed for this end-use are similar to those proposed for other end-uses. Because of this similarity, EPA discusses the use conditions that would apply to all five end-uses in section II.H. In summary, the common use conditions proposed include the following: restricting the use of the refrigerant to new equipment that is specifically designed for that refrigerant; use consistent with the 2<sup>nd</sup> edition of 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

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flammability hazards. The regulatory text of the proposed decisions appears in tables at the end of this document.

If the regulatory text is finalized as proposed, EPA would revise the existing listing for R-290 in new self-contained commercial ice machines in appendix V of 40 CFR part 82, subpart G. The proposed regulatory text contains listing decisions for new self-contained commercial ice machines in appendix V, as well as certain other previous listings that EPA is republishing for purposes of formatting for the *Federal Register*; EPA is not proposing substantive changes to, and is not taking comment on, those earlier decisions (i.e., 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 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 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 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 proposed 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 substitute in self-contained commercial ice

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machines. The risk screen is available in the docket for this proposed rule.<sup>44</sup>

*4. What use conditions currently 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 of 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 the standard 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)

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<sup>44</sup> ICF, 2023q. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: (R-290).

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found that with the use conditions, the overall risk of this substitute, including the risk due to flammability, was not significantly greater risk in this end-use than other substitutes that are currently or potentially available for that same end-use.

*5. What updates to the existing use conditions for commercial ice machines is EPA proposing?*

EPA is proposing to update the use conditions that apply to R-290 in new self-contained commercial ice machines manufactured on or after the effective date of any final rule based on this proposal. Several of the updated use conditions proposed for use of R-290 in self-contained commercial ice machines are common to those proposed for the stand-alone units end-use in section II.B, and other are common to all five end-uses in this proposed rule. Because of this similarity, EPA discusses the use conditions that would apply to all five end-uses in section II.H. For R-290 in self-contained commercial ice machines, these are the only revised use conditions EPA is proposing. In summary, with the updates proposed to the use conditions for new self-contained commercial ice machines, the common use conditions proposed include the following: restricting the use of the refrigerant to new equipment that is specifically designed for that refrigerant; use consistent with the 2<sup>nd</sup> edition of 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.

If finalized as proposed, the use conditions in this action would apply to new self-contained commercial ice machines manufactured on or after the effective date of the final rule. Any final rule would not apply to nor affect equipment manufactured before

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the effective date of this action and manufactured in compliance with the SNAP use conditions applicable at the time of manufacture as stipulated in SNAP Rule 21 and appendix V of 40 CFR part 82, subpart G. 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. If this rule is finalized as proposed, new self-contained commercial ice machines manufactured between January 3, 2017, and the effective date of the final rule based on this proposal would be required to meet the use conditions in SNAP Rule 21 (which took effect January 3, 2017) and as listed in appendix V of 40 CFR part 82, subpart G (in listing 1), including the use condition incorporating by reference Supplement SA to the 8<sup>th</sup> edition of UL 563. Such products would be permitted to be warehoused and sold through normal channels, even if they are sold or installed after the effective date of any final rule based on this proposed rule. Self-contained ice machines using R-290 manufactured on or after the effective date of any final rule based on this proposal through September 29, 2024, would be required to meet the use conditions so finalized and listed in the revisions to appendix V. Those use conditions would allow manufacturers of new self-contained commercial ice machines using R-290 to follow either UL 563 or UL 60335-2-89 from the effective date of any final rule based on this proposal and would last through September 29, 2024. On and after September 30, 2024, the use condition for use of R-290 in equipment that meets UL 60335-2-89 only would apply under SNAP.

EPA is proposing use conditions allowing new self-contained commercial ice

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machines to be manufactured consistent with Supplement SA of UL 563, up to and including September 29, 2024, which is the date when UL is sunsetting UL 563.

Therefore, during the time between the effective date of any final rule based on this proposal and September 29, 2024, manufacturers would be allowed to follow either UL 563, 8<sup>th</sup> Edition or UL 60335-2-89, 2<sup>nd</sup> Edition. EPA is proposing 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. EPA proposes that, beginning September 30, 2024, R-290 may only be used in new self-contained commercial ice machines that meet all requirements in UL 60335-2-89 for the purposes of the SNAP program. See section II.H.1 for further discussion on the requirements of this standard that EPA is proposing to incorporate by reference.

In addition, we are proposing that manufacturers would need to follow the set of use conditions that correspond with a specific UL standard (*i.e.*, when using UL 563, follow all existing use conditions in listing 1 and when using UL 60335-2-89, follow all use conditions in listing 3 in the proposed revisions to appendix V). After the transition period ends, stand-alone units manufactured with R-290 would need to follow UL 60335-2-89 for purposes of the SNAP program.

EPA also notes that we are not proposing to change two use conditions that currently apply, nor are we taking comment on those other 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



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devices through which the refrigerant is serviced, are current use conditions for R-290 in new self-contained commercial ice machines.

If the regulatory text is finalized as proposed, EPA would amend to add use conditions that apply to R-290 in new self-contained commercial ice machines manufactured on or after the effective date of the final rule. Equipment manufactured before the effective date of the final rule would not be affected by this action and would hence be subject to the current use conditions included in appendix V.

*6. How do the proposed use conditions for commercial ice machines differ from the existing ones and why is EPA proposing to change the use conditions?*

The updated use conditions EPA is proposing are similar to the ones that exist today in appendix V of 40 CFR part 82, subpart G for R-290 in this end-use. The proposed 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 proposed listing. The revised use conditions concern incorporating by reference the most recent U.S. national 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 a final rule based on this proposal would not be affected by the revised use conditions.

Warning labels are required under EPA's current regulations, and EPA is proposing to continue to require them, although with some specific language changes. EPA is proposing warning labels that are identical to those required as use conditions for the use of R-290 in self-contained commercial ice machines. EPA finds that using a

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common set of labels, similar to those from UL 60335-2-89, would aid in compliance and could reduce burden for the industry, especially for a manufacturer that uses more than one refrigerant. EPA is proposing 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 current requirement for R-290 in self-contained commercial ice machines.

EPA is proposing to update the standard incorporated by reference in the use conditions, and after a transition period, replacing the requirement to follow Supplement SA of the 8<sup>th</sup> edition of UL 563 with the proposed requirement to adhere to the 2<sup>nd</sup> edition of UL 60335-2-89. 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 2<sup>nd</sup> 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 8<sup>th</sup> edition by that time. EPA was aware of the continuing progress of UL Standards to address flammable refrigerants more appropriately. Today, we are proposing such a change knowing that UL is replacing the standard to which such equipment is certified 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 current use condition using the 8<sup>th</sup> edition of UL 563, and the new use condition using the 2<sup>nd</sup> edition of UL 60335-2-89, EPA is proposing to allow 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. We propose that transition period

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would begin on the effective date of any final rule based on this proposal and would last through September 29, 2024. It is EPA's understanding that UL intends to sunset UL 563 on September 29, 2024, and EPA is proposing to coordinate with that sunset date.

Beginning September 30, 2024, the use condition in effect would only allow R-290 to be used in new self-contained commercial ice machines that follow UL 60335-2-89. In addition, we are proposing that manufacturers would need to 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 proposed revisions to appendix V).

Incorporating UL 60335-2-89 by reference in a use condition would allow the industry to manufacture and test refrigeration equipment following the most recent standard, which provides additional flexibility and safeguards when using flammable refrigerants. The transition period when equipment may follow either UL standard would be helpful in implementing any transitions needed or planned for manufacturers, installers, and technicians. A manufacturer, who may offer different products within this end-use with different refrigerants, could use similar processes, such as in developing and applying the warning labels required.

Another proposed revision to the use conditions is the limit on charge sizes. The current use conditions from SNAP Rule 21 require the charge sizes from UL 563 calculated consistent with UL 563, with a maximum charge size of 150 g allowed. The proposed revised use conditions for equipment manufactured on or after the effective date of any final rule would allow charge sizes calculated based on UL 60335-2-89, which would allow charge sizes of R-290 up to approximately 500 g for open equipment, 300 g

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for equipment with doors or drawers, or 115 g for equipment near a pathway for egress. These changes would allow the use of R-290 in larger equipment than previously and would provide more options for industry, while maintaining 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 commercial ice machines.<sup>45</sup> 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 proposed use condition and consistent with UL 60335-2-89, and thus the proposed new use conditions would also address potential flammability risks of using R-290.<sup>46</sup> 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.<sup>47</sup> For further information, see the risk screen in the docket for this rulemaking.

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

EPA is providing additional information related to this proposed 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. See section

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<sup>45</sup> ICF, 2023q. Op. cit.

<sup>46</sup> Ibid.

<sup>47</sup> Ibid.

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II.H.2 for further discussion on what additional information EPA is including in these proposed listings. EPA notes that the additional information is similar to, but not identical with, the addition information in the listing for R-290 in self-contained commercial ice machines in SNAP Rule 21. EPA is proposing additional information consistent with that included in the other proposed listings for stand-alone units in this rule and consistent with that included in the listings for R-290 as acceptable, subject to use conditions, in self-contained commercial ice machines in Rule 21. 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.

*8. On which topics is EPA specifically requesting comment?*

EPA is requesting comment on all aspects of the proposed updates to the use conditions as discussed in this section II.D. EPA requests comments on the proposed change in use conditions and if and how such change would affect the safety of self-contained commercial ice machines using R-290. EPA is requesting comment on the risk mitigation offered by compliance with the current version of the standard proposed as use conditions, *i.e.*, UL 60335-2-89, the nature of updates proposed for this standard, and the expected timeline for those updates. The Agency also requests comment on allowing a transition period where either of two sets of use conditions, including either UL 563 or UL 60335-2-89, may be followed and on the specific dates for the transition period. EPA is requesting comment on the applicability of the 2<sup>nd</sup> edition of UL 60335-2-89 to new self-contained commercial ice machines, including which types of equipment, under which applications the standard applies, and whether the listing of R-290 should apply to commercial ice machines that have a remote compressor and are not self-contained.

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*E. Industrial process refrigeration—Proposed 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.*

EPA is proposing to list 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 industrial process refrigeration.

Most of the use conditions proposed for the proposed A2L refrigerants when used in IPR are the same as those proposed for other end-uses. Because of this similarity, EPA discusses the use conditions that would apply to all five end-uses in section II.H. In summary, the common use conditions proposed include the following: restricting the use of each refrigerant to new equipment that is specifically designed for that refrigerant; use consistent with the 2<sup>nd</sup> edition of 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 following use condition also applies for R-32 and R-454B in industrial process refrigeration: these substitutes may only be used in chillers for IPR.

The following use condition also applies for R-454A in IPR: this substitute may only be used either in chillers for IPR, 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 proposed decisions appears in tables at the end of this document. If finalized as proposed, this text would be codified in appendix Y of 40 CFR part 82, subpart G. The proposed regulatory text contains listing decisions for the end-use

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discussed above. EPA notes that there may be other legal obligations pertaining to the manufacture, use, handling, and disposal of the proposed 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 260-270).

### *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 substitute for specific applications depends on ambient and required operating temperatures and pressures. It is EPA's understanding that this type of equipment generally 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." In contrast, industrial process air conditioning primarily cools people, may also cool processes, and follows a different UL standard. In addition, sometimes chillers are used primarily to cool process streams, rather than for comfort cooling. EPA describes this application as "chillers in IPR."

### *2. What are the ASHRAE classifications for refrigerant flammability?*

ASHRAE 34-2022 categorizes the refrigerants proposed for IPR in this section as being in the A2L Safety Group. See section II.A.2 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*

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*refrigerants in the same end-use?*

See section II.A.3 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), blends R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A is provided in the docket for this proposed 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 substitutes. These risk screens are available in the docket for this proposed rule.<sup>48 49 50 51 52 53 54 55 56</sup>

*Comparison to other substitutes in this end-use:* HFC-32, HFO-1234yf, HFO-1234ze(E), and 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 IPR equipment, such as HFC-134a, R-410A, and R-513A with ODPs of zero and

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<sup>48</sup> ICF, 2023r. Risk Screen on Substitutes in Industrial Process Refrigeration (New Equipment); Substitute: HFC-32 (Difluoromethane).

<sup>49</sup> ICF, 2023s. Risk Screen on Substitutes in Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks (New Equipment); Substitute: HFO-1234yf.

<sup>50</sup> 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).

<sup>51</sup> ICF, 2023u. Risk Screen on Substitutes in Industrial Process Refrigeration and Cold Storage Warehouses (New Equipment); Substitute: R-454A (Opteon® XL40).

<sup>52</sup> ICF, 2023v. Risk Screen on Substitutes in Industrial Process Refrigeration (New Equipment); Substitute: R-454B (Opteon® XL41).

<sup>53</sup> ICF, 2023w. Risk Screen on Substitutes in Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks (New Equipment); Substitute: R-454C (Opteon™ XL20).

<sup>54</sup> ICF, 2023x. Risk Screen on Substitutes in Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks (New Equipment); Substitute: R-455A (Solstice® L40X).

<sup>55</sup> ICF, 2023y. Risk Screen on Substitutes in Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks (New Equipment); Substitute: R-457A.

<sup>56</sup> ICF, 2023z. Risk Screen on Substitutes in Industrial Process Refrigeration, Cold Storage Warehouses, and Ice Skating Rinks (New Equipment); Substitute: R-516A.



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hydrochlorofluoroolefin (HCFO)-1233zd(E) with an ODP less than 0.0004.<sup>57</sup>

HFO-1234yf and HFO-1234ze(E) have GWPs less than four and less than six, respectively, comparable to that of R-290 and ammonia with GWPs of 3 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 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 refrigerant that have typically been employed in chillers for IPR.

Information regarding the toxicity of other available alternatives is provided in the previous listing decisions for new IPR (<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, is evaluated in the risk screens referenced above. 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 the proposed refrigerants can be mitigated by use consistent with ASHRAE 15-2022 and

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<sup>57</sup> WMO, 2018.

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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 lower flammability limits, are evaluated in the risk screens referenced in this section above. 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 UL 60335-2-89, required by our proposed 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 proposing use conditions to reduce the potential risk associated with the flammability of the proposed alternatives so that they will not pose significantly greater risk than other acceptable substitutes in the new IPR end-use.

In addition, the proposed substitutes have lower GWPs than most other available alternatives for the same uses. The proposed 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

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ensure the availability of substitutes for the full range of IPR equipment with lower GWP and, therefore, lower overall risk to human health and the environment, EPA is proposing the listings for 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 proposing to list the refrigerants HFC-32 and R-454B with a use condition restricting their use to chillers in IPR. These refrigerants have higher GWPs than the other refrigerants EPA is proposing to list as acceptable, subject to use conditions; lower GWPs than many currently listed acceptable substitutes for IPR that are commonly in use; and lower flammability than HC refrigerants currently listed as acceptable in IPR. 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.

EPA is also proposing to list 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, or in the high temperature side of a cascade system. 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 ice skating rinks with moderate charge sizes and for cascade systems, EPA is proposing to list R-454A as acceptable, subject to use conditions, for use in new ice skating rinks with

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a charge size capacity less than 200 pounds or for use in the high-temperature side of a cascade system.

*4. Why is EPA proposing these specific use conditions?*

The use conditions identified in the proposed listings above for all nine refrigerants are explained in section II.H.1 in greater detail.

EPA is proposing the use condition for HFC-32 and R-454B restricting their use to chillers for IPR because these substitutes 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), EPA is proposing to list these two additional refrigerants to provide additional options and to address a broader range of equipment and applications. EPA also is proposing a use condition for R-454A that would allow its use in chillers for IPR, as well as other certain other applications, as described below in this section. In addition, the Agency previously listed HFC-32, R-454A, and R-454B as acceptable, subject to use conditions, in centrifugal and positive displacement chillers for comfort cooling in SNAP Rule 25. EPA is proposing to list the same refrigerants the same way for the same type of equipment (chillers) because of similar technical issues, such as volumetric capacity and operating pressure, which restrict the technical viability of alternatives for some applications.

EPA is proposing to list R-454A as acceptable, subject to use conditions, in IPR with a use condition that this substitute may only be used in chillers for IPR, in equipment with a refrigerant charge capacity less than 200 pounds or in the high-temperature side of a cascade system. EPA is proposing to allow use of R-454A for use in chillers for IPR for the same reasons as above for HFC-32 and R-454B. The Agency is

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also proposing 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 proposed listings for non-chiller IPR equipment (that has a GWP of about 240, compared to less than four to 150). EPA's understanding is that, in addition to the technical constraints for refrigerant in chillers, there are two more situations where use of refrigerants is likely to be more constrained, and thus, additional refrigerant options may be helpful. The first of those situations is in what 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 200 pounds for applications inside an occupied space where people might be located. 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 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, such as where charge sizes of 200 pounds or more of A2L refrigerant would be allowed under the use conditions incorporating UL 60335-2-89 and ASHRAE 15-2022, there would be fewer space constraints and greater flexibility in equipment design, so refrigeration system designers can accommodate a narrower set of substitutes. Conversely, where people are more likely to come into contact with any leaked refrigerant in an interior space, refrigerant charge capacities of a system would be less than 200 pounds; there would be more space constraints, less flexibility in equipment design, and potentially stricter code

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requirements, leading to a need for more refrigerant options. Allowing the additional option of R-424A for non-chiller IPR equipment with smaller refrigerant charges would enable the use of a wider set of available substitutes to manage safety (in particular, flammability and toxicity), as well as allowing more options to achieve adequate performance where there may be more constraints. Therefore, EPA is proposing to list R-454A as acceptable, subject to use conditions, only for non-chiller IPR equipment with a refrigerant charge capacity less than 200 pounds.

EPA is also proposing to list R-454A as acceptable, subject to use conditions, for use in the high temperature side of cascade systems used for non-chiller IPR equipment. As discussed above in section II.A.1, “Background on retail food refrigeration,” each system 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, low boiling refrigerants 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 standards). EPA notes that there are a number of substitutes available for the low temperature side of the cascade system with GWPs lower than that of R-454A. Therefore,

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instead of proposing to list R-454A as acceptable, subject to narrowed use limits and subject to use conditions, EPA is proposing to list 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.

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

EPA is providing additional information related to these proposed 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. See section II.H.2 for further discussion on what additional information EPA is including in these proposed listings. 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.

*6. On which topics is EPA specifically requesting comment?*

EPA is requesting comment on all aspects of the proposed decision to list HFC-32, HFO-1234yf, HFO-1234ze(E), and the refrigerant blends R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A acceptable, subject to use conditions, in IPR as discussed in this section II.E. EPA seeks comment on the risk mitigation offered by the proposed use conditions, including requiring compliance with the 2<sup>nd</sup> edition of UL 60335-2-89, except to the extent the proposed rule conflicts with the UL standard, in which case we propose that the conditions specified in the rule would apply. We also request comment

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on whether other use conditions would offer needed risk mitigation for the flammable refrigerants proposed. EPA requests comment on whether types of IPR equipment have been designed for the refrigerants proposed; any information on the safety of such equipment in other countries; and if and how such experience would translate to safe use in the United States. The Agency requests comment on whether HFC-32, R-454A, and R-454B should be listed as acceptable for chillers in IPR given their higher GWP than some other alternatives listed as acceptable, if they should not be listed in IPR at all, or if they should be listed as acceptable for all types of IPR equipment, and if so, why. Depending on public comments and information received, EPA may revise the substitutes listed with a use condition for use only in chillers for IPR or may not finalize some of the proposed listings.

*F. Cold Storage Warehouses—Proposed 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.*

EPA is proposing to list 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 proposed for cold storage warehouses are common to those proposed for the other end-uses in this rule. Because of this similarity, EPA discusses the use conditions that would apply to all five end-uses in section II.H. In summary, the common use conditions proposed include the following: restricting the use of each refrigerant to new equipment that is specifically designed for that refrigerant; use consistent with the 2<sup>nd</sup> edition of UL 60335-2-89, including testing, charge sizes,



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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 following proposed use condition would also apply 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 proposed decisions appears in tables at the end of this document. If finalized as proposed, this text would be codified in appendix Y of 40 CFR part 82, subpart G. The proposed regulatory text contains listing decisions for the end-use discussed above. EPA notes that there may be other legal obligations pertaining to the manufacture, use, handling, and disposal of the proposed refrigerants that are not included in the information listed in the tables (*e.g.*, the CAA section 608(c)(2) venting prohibition, or Department of Transportation 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 260-270).

#### *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

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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 (R-717). 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 falls 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.”

EPA is proposing to list 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 proposed for cold storage warehouses in this section as being in the A2L Safety Group. See section II.A.2 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 for further discussion on the environmental, flammability, toxicity, and exposure information for HFO-1234yf, HFO-1234ze(E), R-454A, R-454C,

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R-455A, R-457A, and R-516A.<sup>58</sup>

Redacted submissions and supporting documentation for HFO-1234yf, HFO-1234ze(E), and the refrigerant blends are provided in the docket for this proposed rule (EPA-HQ-OAR-2023-0043) at <https://www.regulations.gov>. EPA performed risk screening assessments to examine the health and environmental risks of each of these substitutes. These risk screens are available in the docket for this proposed rule.<sup>59 60 61 62 63 64 65</sup>

*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) have GWPs less than four and less than six, respectively, comparable to that of (HCFO)-1233zd(E), CO<sub>2</sub>, 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), CO<sub>2</sub>, and ammonia with GWPs of

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<sup>58</sup> 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 HPs (86 FR 24444, May 6, 2021).

<sup>59</sup> ICF, 2023s. Op. cit.

<sup>60</sup> ICF, 2023t. Op. cit.

<sup>61</sup> ICF, 2023u. Op. cit.

<sup>62</sup> ICF, 2023w. Op. cit.

<sup>63</sup> ICF, 2023x. Op. cit.

<sup>64</sup> ICF, 2023y. Op. cit.

<sup>65</sup> ICF, 2023z. Op. cit.

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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 above. 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 proposed refrigerants can be minimized 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 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 lower flammability limits, are evaluated in the risk screens referenced above. 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 our proposed use conditions – as well as recommendations in the manufacturers' SDS and other safety precautions common in the refrigeration and AC industry. EPA is proposing use conditions to reduce the potential risk associated with the flammability of these alternatives so that they will not pose significantly greater risk than other acceptable substitutes in this end-use.

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The proposed 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 substitutes for the full range of cold storage warehouses with lower GWP and, therefore, lower overall risk to human health and the environment, EPA is proposing the listings for 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 proposing to list 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 proposing these specific use conditions?*

The proposed use conditions identified in the proposed listings above are explained in section II.H.1.

This proposal applies to end-uses covered by UL 60335-2-89, including the SNAP cold storage warehouses end-use. In addition, ASHRAE 15-2022 applies to these refrigeration systems.

The standard UL 60335-2-89 discussed in section II.H indicates that refrigerant charges greater than a specific amount (called “m<sub>3</sub>” in the standard and based on the

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refrigerant's LFL) are beyond its scope and that national standards might apply, such as ASHRAE 15-2022. Hence, EPA is proposing to require adherence to both standards as use conditions for cold storage warehouses, broadening the coverage under this proposed rule.

EPA is proposing to incorporate by reference ASHRAE 15-2022, including all addenda published by the date of this proposal, in use conditions that apply to use of the proposed A2L refrigerants in new cold storage warehouses. Where the requirements specified in this proposed rule (if finalized) and ASHRAE 15-2022 differ, the requirements of this rule would apply.

EPA recognizes that ASHRAE 15-2022 is undergoing continuous maintenance with publication of periodic addenda and is typically updated and republished every three years. While this proposed rule incorporates all addenda to ASHRAE 15-2022 published by the date of this proposal, there may be additional changes by the time EPA issues a final rule based upon this proposal. However, given EPA would not have reviewed and proposed use conditions based on those changes, EPA is not proposing to include addenda or other changes made to ASHRAE 15-2022 after the date of the proposed rule.

EPA is proposing to list R-454A as acceptable, subject to use conditions, in cold storage warehouses with a use condition 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 proposing this use condition to allow use of R-454A less broadly than for the other refrigerants proposed for use in cold storage warehouses because its GWP is higher than those of the other proposed listings for this end-use (about 240, compared to less than four to 150). EPA's understanding is

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that there are two particular situations where use of refrigerants could be more constrained, and thus, additional refrigerant options 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 200 pounds 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 refrigerant, such as systems used outdoors or in a machinery room with access restricted to employees. Where people are unlikely to come into contact with any leaked refrigerant, such as where charge sizes of 200 pounds or more of A2L refrigerant would be allowed under the use conditions incorporating UL 60335-2-89 and ASHRAE 15-2022, there would be fewer space constraints and greater flexibility in equipment design, so refrigeration system designers can accommodate a narrower set of substitutes. Conversely, where people are more likely to come into contact with any leaked refrigerant in an interior space, refrigerant charge capacities of a system would be less than 200 pounds; there would be more space constraints, less flexibility in equipment design, and potentially stricter code requirements, leading to a need for more refrigerant options. Allowing the additional option of R-454A for cold storage warehouses with smaller refrigerant charges would enable the use of a wider set of available substitutes to manage safety (in particular, flammability and toxicity), as well as allowing more options to achieve adequate performance where there may be more constraints. Therefore, EPA is

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proposing to list R-454A as acceptable, subject to use conditions, only for cold storage warehouses with a refrigerant charge capacity less than 200 pounds.

EPA is also proposing to list R-454A as acceptable, subject to use conditions, for use in the high temperature side of cascade systems used for cold storage warehouses. As discussed above in section II.A.1, “Background on retail food refrigeration,” each system 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, low boiling refrigerants 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 standards). EPA notes that there are a number of substitutes available for the low temperature side of the cascade system with GWPs lower than that of R-454A. Therefore, instead of proposing to list R-454A as acceptable, subject to narrowed use limits and subject to use conditions, EPA is proposing to list 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



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side of a cascade system.

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

EPA is providing additional information related to these proposed 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. See section II.H.2 for further discussion on what additional information EPA is including in these proposed listings. 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.

*6. On which topics is EPA specifically requesting comment?*

EPA is requesting comment on all aspects of the proposed decision to list HFO-1234yf, HFO-1234ze(E), R-454A, R-454C, R-455A, R-457A, and R-516A acceptable, subject to use conditions, in new cold storage warehouses as discussed in this section II.F. EPA seeks comment on the risk mitigation offered by the proposed use conditions, including requiring compliance with the 2<sup>nd</sup> edition of UL 60335-2-89 under the SNAP program, except to the extent the proposed rule conflicts with the UL Standard, in which case we propose that the use conditions specified in the rule would apply. The Agency takes comment on our proposal to limit R-454A to use either in equipment with a refrigerant charge capacity less than 200 pounds or in the high temperature side of a cascade system. We also request comment on whether EPA should consider other use conditions to further mitigate potential risk from refrigerants. EPA requests comment on whether cold storage warehouses have been designed for or manufactured with the

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refrigerants proposed and any information on the safety of such equipment in other countries, and if and how such experience would translate to safe use in the United States.

*G. Ice Skating Rinks—Proposed 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.*

EPA is proposing to list 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.

Several use conditions proposed for ice skating rinks with a remote compressor are common to those proposed for other end-uses. Because of this similarity, EPA discusses the use conditions that would apply to all five end-uses in section II.H. For ice skating rinks with remote compressors, those are the only use conditions EPA is proposing. In summary, the common use conditions proposed include the following: restricting the use of each refrigerant to new equipment that is specifically designed for that refrigerant; use consistent with the 2<sup>nd</sup> edition of 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 proposed decisions appears in tables at the end of this document. If finalized as proposed, this text would be codified in appendix Y of 40 CFR part 82, subpart G. EPA notes that there may be other legal obligations pertaining to the manufacture, use, handling, and disposal of the proposed refrigerants that are not

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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 260-270).

### *1. Background on ice skating rinks*

Ice skating rinks, an end-use within the SNAP program, are used by the general public for recreational purposes and also include professional rinks. 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 proposed listings would apply only to ice skating rinks that have a remote compressor.

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 (R-717). 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, CO<sub>2</sub>, HCFO-1233zd(E) as well as HFCs and HFC/HFO blends. These can be used alone or in

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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). This type of equipment 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.”

*2. What are the ASHRAE classifications for refrigerant flammability?*

ASHRAE Standard 34-2022 categorizes the refrigerants proposed for ice skating rinks in this section as being in the A2L Safety Group. See section II.A.2 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 for further discussion on the environmental, flammability, toxicity, and exposure information for these refrigerants.<sup>66</sup>

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 proposed 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 substitutes. These risk screens are

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<sup>66</sup> 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-454C, and R-457A as acceptable, subject to use conditions, as substitutes in residential and light commercial AC and HPs (86 FR 24444, May 6, 2021).

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available in the docket for this proposed rule.<sup>67 68 69 70 71 72</sup>

*Comparison to other substitutes in this end-use:* HFO-1234yf, HFO-1234ze(E) and 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) have GWPs of less than four and less than six, respectively, comparable to or lower than that of other acceptable substitutes for new ice skating rinks, such as ammonia, CO<sub>2</sub>, 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, CO<sub>2</sub>, 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 acceptable substitutes for new ice skating rinks, such as R-450A, 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 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

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<sup>67</sup> ICF, 2023s. Op. cit.

<sup>68</sup> ICF, 2023t. Op. cit.

<sup>69</sup> ICF, 2023w. Op. cit.

<sup>70</sup> ICF, 2023x. Op. cit.

<sup>71</sup> ICF, 2023y. Op. cit.

<sup>72</sup> ICF, 2023z. Op. cit.

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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 above. The toxicity risks of using HFO-1234yf, HFO-1234ze(E), and 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 proposed refrigerants can be minimized by use consistent with ASHRAE 15-2022 – which would be required by our proposed 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 lower flammability limits, are evaluated in the risk screens referenced above. 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 proposed use conditions – as well as recommendations in the manufacturers’ SDS and other safety precautions common in the refrigeration and AC industry. EPA is proposing use conditions to reduce the potential risk associated with the flammability of these alternatives so that they will not pose significantly greater risk than other acceptable substitutes in this end-use. In addition, EPA is proposing to limit these listings to equipment with a remote compressor. Such equipment reduces the chances of exposure to the general public compared to refrigerants that are piped directly under an ice skating rink. This also can reduce the amount of refrigerant used, potentially reducing

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climate impacts of any refrigerant released.

In addition, the proposed substitutes have lower GWPs than most other available alternatives for the same end-use. The proposed 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 substitutes with lower GWP for more ice skating rinks and, therefore, lower overall risk to human health and the environment, EPA is proposing the listings for 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 proposing these specific use conditions?*

The use conditions identified in the proposed listings above are explained in section II.H.1.

This proposal applies to end-uses covered by UL 60335-2-89, including the SNAP ice skating rinks end-use. In addition, ASHRAE 15-2022 applies to these refrigeration systems.

The standard UL 60335-2-89 discussed in section II.H indicates that refrigerant charges greater than a specific amount (called “m<sub>3</sub>” in the standard and based on the refrigerant’s LFL) are beyond its scope and that national standards might apply, such as ASHRAE 15-2022. Hence, EPA is proposing to require adherence to both standards as use conditions for ice skating rinks, broadening the coverage under this proposed rule.

EPA is proposing to incorporate by reference ASHRAE 15-2022, including all

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addenda published by the date of this proposal, in use conditions that apply to use of the proposed A2L refrigerants in new ice skating rinks. Where the requirements specified in this proposed rule (if finalized) and ASHRAE 15-2022 differ, the requirements of this rule would apply.

EPA recognizes that ASHRAE 15-2022 is undergoing continuous maintenance with publication of periodic addenda and is typically updated and republished every three years. While this proposed rule incorporates all addenda to ASHRAE 15-2022 published by the date of this proposal, there may be additional changes by the time EPA issues a final rule based upon this proposal. However, given EPA would not have reviewed and proposed use conditions based on those changes, EPA is not proposing to include addenda or other changes made to ASHRAE 15-2022 after the date of the proposed rule.

EPA is proposing a use condition that the six A2L refrigerants may only be used in new equipment that includes a remote compressor. This is intended to ensure that these flammable refrigerants, which are likely to use large charge sizes, are only used in situations where the refrigerant is removed 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 proposed listings?*

EPA is providing additional information related to these proposed 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. See section



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II.H.2 for further discussion on what additional information EPA is including in these proposed listings. 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.

*6. On which topics is EPA specifically requesting comment?*

EPA is requesting comment on all aspects of this proposed decision to list HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A as acceptable, subject to use conditions, in new ice skating rinks with a remote compressor as discussed in this section II.G. We request comment on our initial evaluation and our proposal to find HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A acceptable, subject to use conditions, for use in new ice skating rinks. EPA seeks comment on the risk mitigation offered by the proposed use conditions, including requiring compliance with the 2<sup>nd</sup> edition of UL 60335-2-89, except to the extent the proposed rule conflicts with the UL Standard, in which case we propose that the use conditions specified in the rule would apply. We also request comment on whether EPA should consider other use conditions to further mitigate potential risk from refrigerants. EPA requests comment on whether equipment for such ice skating rinks with remote compressors in the United States has already been designed or manufactured for the refrigerants proposed and any information on the safety of such equipment in other countries, and if and how such experience would translate to safe use in the United States. The Agency also requests comment on whether these listings should be restricted to ice skating rinks with a remote compressor, if they should be allowed for any ice skating rink, or if they should be limited to a different subset of ice skating rinks (*e.g.*, for use only in the primary loop of a

secondary loop systems).

*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 proposing and why?*

As described above, EPA is proposing to list:

- 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, 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 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, for use in new chillers for IPR;
- 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

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- 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 proposing to update 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.

These use conditions are summarized in the listings under preamble units II.A, II.C, II.E, II.F, and II.G, and the revisions to the use conditions are summarized under preamble units II.B and II.D and are explained here in greater detail. The proposed use conditions (either as new listings or revisions to an existing listing) include restricting the use of each refrigerant to new equipment that is specifically designed for the refrigerant; use consistent with the 2<sup>nd</sup> edition of 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 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 proposing that these refrigerants may be used only in new equipment

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which has been designed to address concerns unique to flammable refrigerants – i.e., none of these substitutes may 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 for this proposal and is only proposing that they may be used in new equipment which can be properly designed for their use. This proposed use condition would 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 proposed flammable refrigerants, EPA is proposing to incorporate by reference certain industry consensus safety standards in a use condition. Specifically, the Agency is proposing that the flammable refrigerants may be used only in equipment that meets all requirements in the 2<sup>nd</sup> edition of UL 60335-2-89.

Currently, new stand-alone units using R-290 are subject to a use condition to meet the requirements of Appendix SB of the 10<sup>th</sup> edition of the standard UL 471. If this rule becomes final as proposed, stand-alone units using R-290 manufactured before the effective date could continue to be used under SNAP and would remain in compliance with the SNAP use conditions as long as they met the applicable use conditions when they were manufactured. EPA is proposing that new stand-alone units using R-290 manufactured from the effective date of the final rule through September 29, 2024, must

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meet the requirements of either Appendix SB of the 10<sup>th</sup> edition of UL 471 or the 2<sup>nd</sup> edition of UL 60335-2-89. The Agency is also proposing that new stand-alone units using R-290 that are manufactured on or after September 30, 2024, must meet the requirements of the 2<sup>nd</sup> edition of UL 60335-2-89, rather than the earlier UL standards.

Currently, new self-contained commercial ice machines using R-290 must meet the requirements of Appendix SA of the 8<sup>th</sup> edition of UL 563. If this rule becomes final as proposed, commercial ice machines using R-290 manufactured before the effective date of a final rule could continue to be used under SNAP and would remain in compliance with the SNAP use conditions as long as they met the applicable use conditions when they were manufactured. EPA is proposing that new self-contained commercial ice machines using R-290 that are manufactured from the effective date of the final rule through September 29, 2024, must meet the requirements of either Appendix SA of the 8<sup>th</sup> edition of UL 563 or the 2<sup>nd</sup> edition of UL 60335-2-89. The Agency is also proposing that new self-contained commercial ice machines using R-290 that are manufactured on or after September 30, 2024, must meet the requirements of the 2<sup>nd</sup> edition of UL 60335-2-89, rather than the earlier UL standards.

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 in an open and consensus-based approach, with the assistance of experts in the AC and refrigeration industry as well as experts involved in assessing the safety of products. Those participating in the UL 60335-2-89 consensus standards process have tested equipment for flammability risk and evaluated the relevant

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scientific studies. While similar standards exist from other bodies such as the International Electrotechnical Commission (IEC), we are proposing to rely 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 UL 60335-2-89 as they affect the proposed refrigerants and end-uses is offered here for information only and does not provide a complete review of the requirements in this standard.

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. Annex DVU provides guidance on how to apply the requirements to allow for safe use of A2L refrigerants. The 2<sup>nd</sup> edition of 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*

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*refrigerants*); mitigation means (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 (*i.e.*, 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, if the refrigeration circuit with the greatest mass of an A2L refrigerant is more than 260 times the lower flammability limit (in kg/m<sup>3</sup>), such equipment is outside the scope. For example, HFC-32 has an LFL of approximately 0.307 kg/m<sup>3</sup> (0.0192 lb/ft<sup>3</sup>); therefore, equipment with charge sizes of a single circuit exceeding 79.82 kg (176.0 lb) would fall outside the scope of UL 60335-2-89. In such situations, the

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refrigerant 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 (500 g of R-290) for equipment that is open and contains no doors or drawers and eight times the LFL (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 proposing that an additional safety standard, ASHRAE 15-2022, apply to commercial refrigeration equipment using A2L refrigerants, as discussed in section II.A. Certain key provisions of ASHRAE 15-2022 are described above in section II.A; that standard 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, *e.g.*, for use in refrigeration systems with large charge sizes in a machinery room or outdoors.

*Warning Labels—Equipment with A2L refrigerants*

As a use condition or revision to existing use conditions, EPA is proposing to require 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 proposed lower flammability (A2L) refrigerants. The text of these labels can also be found in Annex 101.DVV of UL 60335-2-89. EPA is proposing that 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”
  1. If the equipment is delivered packaged, this label shall be applied on the packaging
  2. 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 1 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 1 or 2, respectively.

5. On indoor unit near the nameplate:
  1. 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 the 2<sup>nd</sup> edition of 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.
  2. Immediately below 5.1. above or at the top of the marking if 5.1. is not required: “Minimum room area (operating or storage), Y m<sup>2</sup> (Z ft<sup>2</sup>)”. 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:

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“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. above 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 only 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 proposing 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 proposing to require the minimum height for lettering must be 1/4 inch as opposed to 1/8 inch. This would make it easier for technicians, consumers, retail storeowners, and

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first responders to view the warning labels.

*Warning Labels—Equipment with A3 refrigerants, including R-290*

As a proposed use condition for refrigerated food processing and dispensing equipment and a proposed revision to existing use conditions for stand-alone units and commercial ice machines, EPA is proposing to require 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. EPA is proposing that the following markings, 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: “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”

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1. If the equipment is delivered packaged, this label shall be applied on the packaging
2. 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 1 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 1 or 2, respectively.

5. On indoor unit near the nameplate:
  1. 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 the 2<sup>nd</sup> edition of 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.
  2. Immediately below 5.1. above or at the top of the marking if 5.1. is not required: “Minimum room area (operating or

storage),  $Y \text{ m}^2$  ( $Z \text{ ft}^2$ )). 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, above, 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 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 proposing in this action. As in the requirements in our previous rules for A3 refrigerants (*i.e.*, 76 FR 78832, December 20, 2011; 80 FR

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19454, April 10, 2015; and 81 FR 86778, December 1, 2016), EPA is proposing that the minimum height for lettering be ¼ inch, which would make it easier for technicians, consumers, retail storeowners, first responders, and those disposing the appliance to view the warning labels.

### *Markings*

EPA is proposing to require 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 proposed are required by UL 60335-2-89 for all flammable refrigerants. EPA is proposing that such markings apply to the proposed listings for flammable refrigerants as well to establish a common, familiar, and standard means of identifying the use of a flammable refrigerant.

These red markings would help technicians immediately identify the use of a flammable refrigerant, thereby reducing the risk of using sparking equipment or otherwise having an ignition source nearby. The AC and refrigeration industry currently

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uses red-colored hoses and piping as means for identifying the use of a flammable refrigerant based on previous SNAP listings. Likewise, distinguishing coloring has been used elsewhere to indicate an unusual and potentially dangerous situation, for example in the use of orange-insulated wires in hybrid electric vehicles. Currently 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 certain types of equipment where these are listed acceptable, subject to use conditions. All such tubing must be colored red PMS #185 or RAL 3020. The intent of this aspect of the proposal is to alert technicians and others that a flammable refrigerant is being used within a particular piece of equipment or appliance. Another goal is to provide adequate notification of the presence of flammable refrigerants for personnel disposing of appliances containing flammable refrigerants. 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 could be used. The colored plastic sleeve, cap, or tape would have to be forcibly removed to access the service tube and would have to be replaced if removed. This would signal to the technician that the refrigeration circuit that she/he was about to access contained a flammable refrigerant, even if all warning labels were somehow removed. This sleeve, 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 proposing the use of color-coded hoses or piping as a way for technicians and others to recognize that a flammable refrigerant is used in the equipment. This would



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be in addition to the proposed use of warning labels discussed above. EPA believes having two such 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 also is proposing to add a new marking to 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 refrigeration equipment that is charged in place. These locations correspond with the locations for red markings and for the 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. UL 60335-2-89 describes markings in section 7, including a triangular symbol with a white picture of a flame on a red background, similar in size and shape to that of the International Organisation for Standardisation (ISO) symbol 7000-W021, but with different coloration (Clause 7.6DV D1). EPA is proposing a new 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. The diamond symbol hazard category 1 flammable gases would need to be at least 15 mm (9/16 inches) high.

EPA understands that in consultation with different fire service groups, such as the International Association of Fire Fighters, UL and its standard-setting committees have been considering appropriate symbols to alert first responders to the presence and potential hazards of flammable refrigerant. One symbol under consideration is an equal-sided diamond with a red outline and a flame symbol on a white background, together

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with the refrigerant class from ASHRAE 34-2022 (*e.g.*, A2L or A3) to be written in text not less than one-third of the height of the symbol. This symbol is included as the warning symbol for hazard category 1 flammable gases in the 9<sup>th</sup> edition of the GHS for communicating risks of chemicals.<sup>73</sup> This symbol for hazard category 1 flammable gases is included in the 4<sup>th</sup> 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 3<sup>rd</sup> edition of UL 60335-2-89. It is found in section 1.2 of Annex 1 of the 9<sup>th</sup> edition of the GHS. You may see the proposed symbol for hazard category 1 flammable gases in the docket for this rulemaking under the title, “Proposed Flammability Hazard Symbol.”

EPA is proposing to add this symbol to ensure the adoption of a symbol for “Caution, risk of fire” that is likely to be recognized by first responders in the United States as well as internationally. The symbol ISO 7000-W021, used in other UL standards for refrigerating equipment, is a black flame symbol on a yellow triangle. U.S. organizations representing fire fighters have raised concerns about that symbol, since it could refer 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. EPA is proposing to include the GHS diamond symbol for hazard category 1 flammable gases prior to UL’s adoption of it in UL 60335-2-89 to provide an additional warning about flammability hazard that is more likely to be

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<sup>73</sup> GHS, 2021. GHS Pictogram for Hazard Category 1 Flammable Gases from Annex 1 to the 9<sup>th</sup> edition of the Global Harmonized System of Classification and Labelling of Chemicals, 2021. You may find the GHS document online at [https://unece.org/sites/default/files/2021-9/GHS\\_Rev9E\\_0.pdf](https://unece.org/sites/default/files/2021-9/GHS_Rev9E_0.pdf) or from the United Nations Publications section at: <https://shop.un.org/books/global-harmon-syst-class-9-92280>.

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recognizable by first responders and internationally than the current symbol in UL 60335-2-89.

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

For retail food refrigeration, commercial ice machines, IPR, cold storage warehouses, and ice skating rinks with remote compressors, EPA is proposing to include recommendations, found in the “Further Information” column of the regulatory text at the end of this document, to protect personnel from the risks of using flammable refrigerants. Similar to our previous listings of flammable refrigerants, EPA is proposing to include 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 substitutes.

*3. On which topics is EPA specifically requesting comment?*

EPA is requesting comment on all aspects of the proposed use conditions described above and the appropriateness for applying these use conditions to the listings for A2L refrigerants used in retail food refrigeration, commercial ice machines, IPR and chillers for IPR, cold storage warehouses, and ice skating rinks with remote compressors in sections II.A, II.C, II.E, II.F, and II.G, respectively.

EPA is requesting comment on all aspects of the proposed use conditions

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described above and the appropriateness for applying these use conditions to the listing for R-290 used in refrigerated food processing and the proposed revisions to the use conditions in existing listings for R-290 in stand-alone units and self-contained commercial ice machines in sections II.B and II.D.

EPA is requesting comment on the applicability of UL 60335-2-89 to commercial refrigeration equipment, including for which types of equipment and under which applications the standard applies. We likewise are requesting comment on the applicability of UL 60335-2-89 to commercial ice machines, IPR equipment, cold storage warehouses, and ice skating rinks with remote compressors.

Also, with regard to UL 60335-2-89, EPA is requesting comment on the status of the standard, the modifications that are being or have been incorporated in it, how those modifications would change the risk associated with the use of the proposed flammable refrigerants in these end-uses, and the appropriateness of adopting as a use condition the current (2nd) edition of this standard.

EPA is also requesting comment on requiring labeling, the height of the lettering, the proposed diamond symbol for hazard category 1 flammable gases, and the likelihood of labels remaining on a product throughout the lifecycle of the product, including its disposal.

*I. Proposed exemption for R-290 from the venting prohibition under CAA section 608 for refrigerated food processing and dispensing equipment.*

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

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As described in section I.A above, 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 industrial process refrigeration, 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 industrial process refrigeration) 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 above, EPA is proposing to list 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 proposing to exempt R-290 in this end-use from the venting prohibition under CAA section 608(c)(2), on the basis of current evidence that the venting, release, or disposal of this substance in this end-use and subject to the use conditions in this proposed action does not pose a threat to the environment.

For purposes of CAA section 608(c)(2), EPA considers two factors in determining whether or not venting, release, or disposal of a refrigerant substitute during the maintenance, servicing, repairing, or disposing of appliances poses a threat to the environment. See 69 FR 11948, March 12, 2004; 79 FR 29682, May 23, 2014; 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 venting, release, or disposal actually takes place during the maintenance, servicing,

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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 R-290 into the environment, a substitute that we are proposing to list under the SNAP program 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 sizes 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 (see 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 O<sub>3</sub>/g R-290 is higher and more reactive than that of the compound ethane (MIR of 0.26 g O<sub>3</sub>/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 if emissions of HC refrigerants could have a significant impact on local air quality, particularly in certain cities with particularly difficult challenges in

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achieving attainment of the NAAQS for ground-level ozone. Based on the analysis and modeling results described in section II.B.3, EPA proposes to conclude that the release of R-290 from the refrigerated food processing and dispensing end-use, in addition to the HCs previously listed as acceptable, subject to use conditions, for their specific end-uses, is expected to have little impact on local air quality. In this regard, EPA 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 NAAQS at 70 ppb.<sup>74</sup>

In addition, when examining all HC substitute refrigerants in those uses for which UL currently has standards in place, for which the SNAP program has already listed the uses as acceptable, subject to use conditions, or for which the SNAP program is reviewing a submission, including those in this proposed action, we found that even if all the HC refrigerant substitutes in appliances in end-uses proposed to be listed acceptable, subject to use conditions, in this action and listed as acceptable in previous rules were to be emitted, there would be a worst-case impact of less than 0.15 ppb for ground-level ozone in the Los Angeles area.<sup>75</sup> 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. Because

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<sup>74</sup> ICF, 2016. Additional Follow-on Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. September, 2016.

<sup>75</sup> ICF, 2014a. Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. February 2014.

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R-290 is not listed as acceptable for use in all refrigerant uses, the total amount of R-290 that could be emitted in the end-uses evaluated is estimated at roughly ten percent of total refrigerant emissions, or less than 16,000 metric tons annually.<sup>76</sup> In comparison, total anthropogenic VOC emissions were estimated at 19.6 million metric tons in 2017.<sup>77</sup> Further, there are other substitute refrigerants that are not VOC that may also be used in these end-uses, so our analysis assuming complete market penetration of HCs is conservative.

EPA also has performed more recent air quality analysis, 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.<sup>78</sup> 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, 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 2020 analysis compared to 7.8 ppb in Los Angeles in an analysis in 2016 looking at the same scenario with the same refrigerant. Changes to the 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

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<sup>76</sup> Ibid.

<sup>77</sup> U.S. EPA, 2020. 2017 National Emissions Inventory Report. U.S. Environmental Protection Agency. Available online at <https://gispub.epa.gov/neireport/2017/>.

<sup>78</sup> ICF, 2020. 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, 2020.



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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.<sup>79</sup> Looking at the 2020 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 2016 analysis, the 2020 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). The modeled changes to ground-level ozone levels were less than 0.017 percent of the NAAQS 8-hour ozone concentration of 70 ppb.<sup>80</sup> EPA considers this 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.

Considering our evaluation of these potential environmental impacts, EPA proposes to conclude 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.

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<sup>79</sup> ICF, 2016. Additional Follow-on Assessment of the Potential Impact of Hydrocarbon Refrigerants on Ground Level Ozone Concentrations. September 2016.

<sup>80</sup> ICF, 2020. Op cit.

### **Authorities, controls, 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, 2016, and 2022 (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. As explained below, EPA proposes 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.

As mentioned above, 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. This information is another part of EPA's proposal that the venting, release, or disposal of R-290, in the specified end-use and subject to the use conditions in this proposed action, does not pose a threat to the environment.

Industry service practices and OSHA standards and guidelines that address HC refrigeration equipment include monitoring efforts, engineering controls, and operating procedures. OSHA requirements that apply during servicing include continuous monitoring of explosive gas concentrations and oxygen levels. In general, HC emissions from refrigeration systems are likely to be significantly smaller than those emanating from the industrial process and storage systems, which are controlled for safety reasons. In sections II.B.7, "What updates to existing use conditions for stand-alone units is EPA

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proposing?” and II.D.5, “What updates to existing use conditions for commercial ice machines is EPA proposing?” above in this document, we note that the amount of substitute refrigerant from a refrigerant loop is effectively limited to 500 g or 300 g in the end-uses proposed in this rule. This indicates that HC emissions from such uses are likely to be relatively small.

As discussed above 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 proposed new end-use in this 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 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 proposal provides recommendations for its safe use (see section II.H.2, “What additional information is EPA including in these proposed listings?”). The SNAP program’s analysis suggests that the proposed 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 proposed use conditions in this rule would mitigate asphyxiation and toxicity risks. Furthermore, it is the Agency’s understanding that flammability risks and

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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 proposing to incorporate 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 15-2022 are in the process of being adopted in the next version of the IBC; once the IBC adopts those standards, states 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.

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*2. What is EPA's proposal regarding whether venting of R-290 from refrigerated food processing and dispensing equipment should be exempted from the venting prohibition under CAA section 608(c)(2)?*

Consistent with the proposed listing under SNAP in this action, EPA proposes to determine 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 more fully above, we propose this on the basis of the inherent characteristics of this substance, the limited quantities used in the relevant end-uses, and the limits and controls under other authorities, regulations, or practices that adequately control the release of and exposure to R-290 and mitigate risks from any possible release. Accordingly, EPA is proposing to revise the regulations at 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 would the exemption from the venting prohibition apply?*

We are proposing that this exemption for R-290 in refrigerated food processing and dispensing equipment would apply as of 30 days after the publication of a final rule in the *Federal Register*. This would be the same as the proposed effective date of the SNAP listing of R-290 in refrigerated food processing and dispensing equipment, if that listing is finalized as proposed.

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

If this proposed exemption were to become final as proposed, it would not mean that R-290 could be vented in all situations. R-290 and other HCs being recovered,

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vented, released, or otherwise disposed of from commercial and industrial appliances are likely to be hazardous waste under RCRA (see 40 CFR Parts 261-270). 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 261-270), 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. On which topics is EPA specifically requesting comment?*

EPA requests comment on all aspects of our proposal to exempt R-290 used as a refrigerant substitute in refrigerated food processing and dispensing equipment from the venting prohibition under CAA section 608(c)(2), as well as seeking comment on the proposed addition to the existing exemption language for R-290 in particular end-uses at 40 CFR 82.154(a)(1)(viii). The Agency notes that the proposed regulatory text contains the proposed addition to 82.154(a)(1)(viii), as well as certain other exemptions for other end-uses that already appear at 40 CFR 82.154(a)(1)(viii) and that EPA is republishing

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for purposes of formatting for the *Federal Register*. EPA is not proposing changes to, and is not taking comment on, those existing exemptions and we are not reopening for comment those current exemptions for the other end-uses where R-290 may be used.

### **III. Statutory and Executive Order Reviews**

*A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review.*

This action is not a significant regulatory action 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

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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 proposes to add the additional options under SNAP of 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 standard; these would 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 a final rule based on this proposal would 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 would result in no adverse impact compared with the absence of this rule. Thus, if the rule were finalized as proposed, it would 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 as described in UMRA, 2



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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

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preferable to potentially effective and reasonably feasible alternatives. This action is not subject to Executive Order 13045 because it is not economically significant as defined in 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 does contain use conditions that would 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 proposed 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.*

This action involves technical standards. EPA uses and proposes to incorporate by reference portions of the 2021 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.

The 2021 standard UL 60335-2-89, "Household And Similar Electrical Appliances - Safety - Part 2-89: Particular Requirements for Commercial Refrigerating

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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-](https://www.shopulstandards.com/ProductDetail.aspx?productId=UL60335-2-89_2_S_20211027)

89\_2\_S\_20211027, and may be purchased by mail at: COMM 2000, 151 Eastern

Avenue, Bensenville, IL 60106; Email: [orders@shopulstandards.com](mailto: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 proposed to be incorporated by reference is reasonably available.

EPA is also proposing to incorporate by reference the GHS diamond symbol (pictogram) for hazard category 1 flammable gases from Annex 1 to the 9<sup>th</sup> edition of the Global Harmonized System of Classification and Labelling of Chemicals, copyrighted in 2021, in the use conditions for hazard labeling of commercial and industrial refrigeration equipment. This document is available for viewing online at:

[https://unece.org/sites/default/files/2021-9/GHS\\_Rev9E\\_0.pdf](https://unece.org/sites/default/files/2021-9/GHS_Rev9E_0.pdf). 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>. The cost of the

9<sup>th</sup> edition of the GHS is \$75.00 for an electronic copy or \$150.00 for a printed hard

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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 GHS symbol proposed to be incorporated by reference is reasonably available.

EPA is also proposing to incorporate by reference ANSI/ASHRAE Standard 15-2022, “Safety Standard for Refrigeration Systems,” in the use conditions for refrigerants listed for use in larger refrigeration equipment and ANSI/ASHRAE Standard 34-2022, “Designation and Safety Classification of Refrigerants,” in the use conditions for labeling refrigeration equipment with the safety classification of the refrigerant used. 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 email at [store@techstreet.com](mailto:store@techstreet.com); by telephone: 1-800-527-4723 **in the U.S. or Canada**; or at Internet address:

[https://www.techstreet.com/ashrae/standards/ashrae-15-2022-packaged-w-standard-34-2022?product\\_id=2504061](https://www.techstreet.com/ashrae/standards/ashrae-15-2022-packaged-w-standard-34-2022?product_id=2504061). 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 these standards 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 proposed to be incorporated by reference are reasonably available.

*J. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations.*

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Executive Order 12898 (59 FR 7629, February 16, 1994) directs federal agencies, to the greatest extent practicable and permitted by law, to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations (people of color and/or indigenous peoples) and low-income populations.

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 people of color, low-income populations and/or indigenous peoples. This action's health and environmental risk assessments are 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. EPA's analysis indicates that other environmental impacts and human health impacts of HFC-32, HFO-1234yf, HFO-1234ze(E), R-290, R-454A, R-454B, R-454C, R-455A, R-457A, and R-516A are comparable to or less than those of other substitutes that are listed as acceptable for the same end-use. Because adoption of the new substitutes listed in this final 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).

EPA believes that it is not practicable to assess whether this action is likely to

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result in new disproportionate and adverse effects on people of color, low-income populations and/or indigenous peoples. The Agency will continue to evaluate the impacts of this program on communities with environmental justice concerns and consider further action, as appropriate.

#### **IV. References**

Unless specified otherwise, all documents are available electronically through the Federal Docket Management System at *regulations.gov*, Docket number EPA-HQ-OAR-2023-0043.

ASHRAE, 2022a. ANSI/ASHRAE Standard 15-2022: Safety Standard for Refrigeration Systems. 2022

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

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.

GHS, 2021. Pictogram for Hazard Category 1 Flammable Gases from Annex 1 to the 9<sup>th</sup> edition of the Global Harmonized System of Classification and Labelling of Chemicals, 2021. Available online at [https://unece.org/sites/default/files/2021-9/GHS\\_Rev9E\\_0.pdf](https://unece.org/sites/default/files/2021-9/GHS_Rev9E_0.pdf) or from the United Nations Publications section at: <https://shop.un.org/books/global-harmon-syst-class-9-92280>.

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

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

ICF, 2020. Additional Assessment of the Potential Impact of Hydrocarbon Refrigerants

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on Ground Level Ozone Concentrations. May, 2020.

ICF, 2023a. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment);  
Substitute: HFO-1234yf.

ICF, 2023b. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment);  
Substitute: HFO-1234ze(E) (Solstice® ze, Solstice® 1234ze).

ICF, 2023c. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment);  
Substitute: R-454A (Opteon® XL40).

ICF, 2023d. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment);  
Substitute: R-454C (Opteon™ XL20).

ICF, 2023e. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment);  
Substitute: R-455A (Solstice® L40X).

ICF, 2023f. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment);  
Substitute: R-457A (Forane® 457A).

ICF, 2023g. Risk Screen on Substitutes in Retail Food Refrigeration (New Equipment);  
Substitute: R-516A (Forane® 516A).

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

ICF, 2023i. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment);  
Substitute: HFC-32.

ICF, 2023j. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment);  
Substitute: HFO-1234yf.

ICF, 2023k. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment);  
Substitute: R-454A (Opteon® XL40).

ICF, 2023l. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment);  
Substitute: R-454B (Opteon® XL41).

ICF, 2023m. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment);  
Substitute: R-454C (Opteon™ XL20).

ICF, 2023n. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment);  
Substitute: R-455A (Solstice® L40X).

ICF, 2023o. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment);

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Substitute: R-457A (Forane® 457A).

ICF, 2023p. Risk Screen on Substitutes in Commercial Ice Machines (New Equipment); Substitute: R-516A (Forane® 516A).

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

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

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

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).

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

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

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

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

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

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

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Nielsen et al., 2007. Nielsen, O.J., Javadi, M.S., Sulbaek Andersen, M.P., Hurley, M.D., Wallington, T.J., Singh, R. (2007). Atmospheric chemistry of CF<sub>3</sub>CF=CH<sub>2</sub>: Kinetics and mechanisms of gas-phase reactions with Cl atoms, OH radicals, and O<sub>3</sub>. *Chemical Physics Letters* 439, 18–22. Available at: [www.lexissecuredmosaic.com/gateway/FedReg/network\\_OJN\\_174\\_CF3CF=C H2.pdf](http://www.lexissecuredmosaic.com/gateway/FedReg/network_OJN_174_CF3CF=C H2.pdf).

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

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

UL 60335-2-89, 2021. 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.

U.S. EPA, 2020. 2017 National Emissions Inventory Report. U.S. Environmental Protection Agency. Available online at <https://gispub.epa.gov/neireport/2017/>.

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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.

Dated:

**Michael S. Regan,**  
*Administrator.*

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For the reasons set forth in the preamble, EPA proposes to amend 40 CFR part 82 as follows:

**PART 82—PROTECTION OF STRATOSPHERIC OZONE**

1. The authority citation for part 82 continues to read as follows:

**Authority:** 42 U.S.C. 7414, 7601, 7671-7671q.

**Subpart G—Significant New Alternatives Policy Program**

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

- a. Revising the heading for appendix R to subpart G of part 82; 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, AND IN THE [date of publication of the final rule] FINAL RULE, EFFECTIVE [effective date of the final rule].**

**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.e., 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 all requirements listed in UL 60335-2-24. <sup>1,2,6</sup>	Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.94 (ventilation), 29 CFR 1910.106 (flammable and combustible liquids), 1910.110 (storage and handling of liquefied petroleum gases), 1910.157 (portable fire extinguishers), and 1910.1000 (toxic and hazardous substances). Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing hydrocarbon refrigerants through adherence to good

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				<p>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 refrigerators and freezers with these refrigerants.</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.</p> <p>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.</p>
2. Retail Food Refrigeration —stand-alone units only (New equipment only) manufactured	Isobutane (R-600a) Propane (R-290) R-441A	Acceptable subject to use conditions	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).	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

<p>on or after February 21, 2012, and up to but not including [effective date of final rule])</p>			<p>These substitutes may only be used in equipment that meets all requirements in Supplement SB to UL 471<sup>1,2,3</sup>. 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,<sup>1,2,3</sup> 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>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.</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 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</p>
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			<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 (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.</p>	<p>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.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>3. Retail Food Refrigeration —stand-alone units only (New equipment only) manufactured from [effective date of final rule] through September 29, 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 all requirements of either:</p> <ol style="list-style-type: none"> <li>1. Supplement SB to UL 471<sup>1,2,3</sup> and listing 2 of this table or</li> <li>2. UL 60335-2-89<sup>1,2,7</sup> and listing 4 of this table.</li> </ol>	
<p>4. Retail Food Refrigeration —stand-alone units only (New equipment only) manufactured on or after 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.e., 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 equipment that meets all requirements in UL 60335-2-89.<sup>1,2,7</sup> In cases where this listing 4 includes requirements more stringent than those of UL 60335-2-89, the appliance must meet the requirements of this listing.<sup>7</sup></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</p>

		<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>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 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,</p>
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			<p>b. Immediately below a or at the top of the marking if a is not required: “Minimum room area (operating or storage), Y m<sup>2</sup> (Z ft<sup>2</sup>).” 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 (¼ inch) high.</p> <p>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>In addition to the markings described in Clauses 7.6 and 7.6DV D1 of UL 60335-2-89, the</p>	<p>2<sup>nd</sup> edition.</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 260-270).</p>
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			<p>equipment must display the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)<sup>1,9,10</sup> 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) on the following three locations:</p> <ul style="list-style-type: none"> <li>• outside of the equipment (label (a));</li> <li>• 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</li> <li>• 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).</li> </ul> <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,<sup>1,11, 12</sup> in letters at least one-third the height of the diamond symbol.</p>	
5. Very low temperature refrigeration. Non-mechanical heat transfer (New equipment only)	Ethane (R-170)	Acceptable subject to use conditions	<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 all requirements in Supplement SB to UL 471.<sup>1,2,3</sup> 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</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</p>

		<p>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,<sup>1,2,3</sup> the following markings must be attached at the locations provided and must 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 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 (PMS) #185 or RAL 3020 marked pipes, hoses, and other devices through which the refrigerant is serviced, typically</p>	<p>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 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</p>
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			<p>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>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>Example of non-mechanical heat transfer using this refrigerant would be use in a secondary loop of a thermosiphon.</p>
<p>6. Vending machines (New equipment only)</p>	<p>Isobutane (R-600a), Propane (R-290), R-441A</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 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 all requirements in Supplement SA to UL 541.<sup>1,2,5</sup> 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,<sup>1,2,5</sup> the following markings must be attached at the locations provided and must be permanent:</p> <p>(a) On or near any evaporators that can be contacted by the</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</p>

		<p>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 (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.</p>	<p>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 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>
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<p>7. Residential and light-commercial air conditioning and heat pumps—self-contained room air conditioners only (New equipment only)</p>	<p>HFC-32, Propane (R-290), R-441A</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 refrigerants (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 only be used in equipment that meets all requirements in Supplement SA and Appendices B through F of UL 484.<sup>1 2,4</sup> 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>As provided in clauses SA6.1.2 to SA6.1.5 of UL 484,<sup>1,2,4</sup> 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</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> <p>Any recovery equipment used should be designed for flammable refrigerants.</p> <p>Any refrigerant releases should be in a well-ventilated</p>
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			<p>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” m<sup>2</sup> (Y ft<sup>2</sup>).” The value “X” on the label must be determined using the minimum room size in m<sup>2</sup> calculated using Appendix F of UL 484. For R-441A, use a lower flammability limit of 0.041 kg/m<sup>3</sup> in calculations in 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 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>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>Air conditioning equipment in this category includes window air conditioning units, portable room air conditioners, and packaged terminal air conditioners and heat pumps.</p>
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<sup>1</sup> 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->

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register/cfr/ibr-locations.html or email [fr.inspection@nara.gov](mailto:fr.inspection@nara.gov).

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

<sup>3</sup> 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.

<sup>4</sup> UL 484. Room Air Conditioners. 8<sup>th</sup> 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.

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

<sup>6</sup> 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, Second edition, dated April 28, 2017.

<sup>7</sup> 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, 3<sup>rd</sup> edition, Dated November 1, 2019.

<sup>8</sup> UL 60335-2-89, Standard 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.

<sup>9</sup> You may obtain the material from: [https://unece.org/sites/default/files/2021-9/GHS\\_Rev9E\\_0.pdf](https://unece.org/sites/default/files/2021-9/GHS_Rev9E_0.pdf) or from the United Nations Publications section at: <https://shop.un.org/books/global-harmon-syst-class-9-92280>.

<sup>10</sup> GHS Pictogram for Hazard Category 1 Flammable Gases from Annex 1 to the 9<sup>th</sup> edition of the Global Harmonized System of Classification and Labelling of Chemicals, copyrighted 2021.

<sup>11</sup> You may obtain the material from: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), 180 Technology Parkway NW, Peachtree Corners, Georgia 30092. 1-800-527-4723 in the U.S. or Canada; by email to [store@techstreet.com](mailto:store@techstreet.com); or online at [www.techstreet.com/ashrae/ashrae\\_standards.html?ashrae\\_auth\\_token=](http://www.techstreet.com/ashrae/ashrae_standards.html?ashrae_auth_token=).

<sup>12</sup> American National Standards Institute /American Society of Heating, Refrigerating and Air Conditioning Engineers (ANSI/ASHRAE) Standard 34-2022. Designation and Safety Classification of Refrigerants. Copyright 2022.

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

a. Revising the heading for appendix V to subpart G of part 82; and

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

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 [date of publication of the final rule] FINAL RULE, EFFECTIVE [effective date of final rule]:

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 [effective date of final rule])	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.e., 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 all requirements listed in Supplement SA to UL 563.<sup>1,2,5</sup> 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</p>	<p>Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.94 (ventilation), 29 CFR 1910.106 (flammable and combustible liquids), 1910.110 (storage and handling of liquefied petroleum gases), 1910.157 (portable fire extinguishers), and 1910.1000 (toxic and hazardous substances).</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</p>



			<p>attached at the locations provided and must be permanent:</p> <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</p>	<p>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.</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.</p> <p>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</p>
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			Pantone Matching System (PMS) #185 marked pipes, hoses, or other devices through which the refrigerant passes, to indicate the use of a flammable refrigerant. This color must be applied at all service ports and other parts of the system where service puncturing or other actions creating an opening from the refrigerant circuit to the atmosphere might be expected and must extend a minimum of one (1) inch in both directions from such locations.	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.
2. Commercial ice machines (self-contained) (new only) manufactured on or after [effective date of final rule] through September 29, 2024	Propane (R-290)	Acceptable subject to use conditions	This refrigerant may be used only in self-contained commercial ice machines that meet all requirements in either: 1. Supplement SA to UL 563 <sup>1,2,5</sup> and listing 1 of this table or 2. UL 60335-2-89 <sup>1,2,6</sup> and listing 3 of this table.	
3. Commercial ice machines (self-contained) (new only) manufactured on or after 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.e., none of these substitutes may be used as a conversion or “retrofit” refrigerant for existing equipment designed for other refrigerants). This substitute may only be used in commercial ice machines that meets all requirements in UL 60335-2-89. <sup>1,2,6</sup> 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. In cases where this listing 3 includes requirements different than those of ASHRAE 15-2022 <sup>1,7,8</sup> the appliance would need to meet the requirements of this listing in place of the requirements in the ASHRAE	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

			<p>Standard. 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>(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>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</p>	<p>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.<sup>2,5</sup></p> <p>CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the</p>
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			<p>near the control panel or nameplate.</p> <p>(e) On indoor units 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 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 m<sup>2</sup> (Z ft<sup>2</sup>)”. 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>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 machine appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260-270).</p>
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			<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 (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 (25 mm) in both directions from such locations and shall be replaced if removed.</p> <p>In addition to the markings described in Clauses 7.6 and 7.6DV D1 of UL 60335-2-89, the equipment must display the Globally Harmonized System of Classification and Labelling of Chemicals (GHS)<sup>1,10,11</sup> 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) on the following three locations:</p> <ul style="list-style-type: none"> <li>• outside of the equipment (label (a));</li> <li>• 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</li> <li>• 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).</li> </ul> <p>The perpendicular height of the diamond containing the GHS</p>	
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			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, <sup>1,7,9</sup> in letters at least one-third the height of the diamond symbol.	
4. Very low temperature refrigeration equipment (new only)	Propane (R-290)	Acceptable subject to use conditions	<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.e., 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 all requirements in Supplement SB to UL 471.<sup>1,2,4</sup> 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>(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</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</p>

			<p>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 (PMS) #185 marked pipes, hoses, or other devices through which the refrigerant passes, to indicate the use of a flammable refrigerant. This color must be applied at all service ports and other parts of the system where service puncturing or other actions creating an opening from the refrigerant circuit to the atmosphere might be expected</p>	<p>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.</p> <p>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.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>Very low temperature equipment using propane may also use another acceptable refrigerant</p>
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			and must extend a minimum of one (1) inch in both directions from such locations.	substitute in a separate refrigerant circuit or stage (e.g., one temperature stage with propane and a second stage with ethane).
5. Water coolers (new only)	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.e., 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 all requirements listed in Supplement SB to UL 399<sup>1,2,3</sup> In cases where this listing 5 includes requirements more stringent than those of the UL 399, the appliance must meet the requirements of this listing 5 in place of the requirements in the UL Standard.</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 (PMS) #185 marked pipes, hoses, or other devices through which the refrigerant passes, to indicate the use of a flammable refrigerant. This color must be applied at all service ports and other parts of the system where service puncturing or other actions creating an opening from the refrigerant circuit to the atmosphere might be expected and must extend a minimum of one (1) inch in both directions from such locations.</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>(a) “DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To</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>



			<p>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.</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 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.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>
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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 U.S. EPA’s Air and Radiation Docket; EPA West Building, Room 3334, 1301 Constitution Ave., N.W., Washington DC 20004 or at the National Archives and Records Administration (NARA). For questions regarding access to these standards, visit, <https://www.epa.gov/dockets>, or call EPA’s Air and Radiation Docket at 202-566-1742. For information on the availability of this material at NARA, call 202-741-6030, go to: <https://www.archives.gov/federal-register/cfr/ibr-locations.html> or email [fr.inspection@nara.gov](mailto:fr.inspection@nara.gov).

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

3. UL 399, Standard for Safety: Drinking Water Coolers- Supplement SB: Requirements for Drinking

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Water Coolers Employing a Flammable Refrigerant in the Refrigerating System, 7<sup>th</sup> 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, 10<sup>th</sup> 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, 8<sup>th</sup> edition, Dated July 31, 2009, including revisions through November 29, 2013.

6. UL 60335-2-89, Standard 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 material from: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), 180 Technology Parkway NW, Peachtree Corners, Georgia 30092. 1-800-527-4723 in the U.S. or Canada; by email to [store@techstreet.com](mailto:store@techstreet.com); or online at [www.techstreet.com/ashrae/ashrae\\_standards.html?ashrae\\_auth\\_token=](http://www.techstreet.com/ashrae/ashrae_standards.html?ashrae_auth_token=).

8. ANSI/ASHRAE Standard 15-2022. Safety Standard for Refrigeration Systems, including all addenda published as of [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER].

9. American National Standards Institute /American Society of Heating, Refrigerating and Air Conditioning Engineers (ANSI/ASHRAE) Standard 34-2022. Designation and Safety Classification of Refrigerants. Copyright 2022.

10. You may obtain this material from: [https://unece.org/sites/default/files/2021-9/GHS\\_Rev9E\\_0.pdf](https://unece.org/sites/default/files/2021-9/GHS_Rev9E_0.pdf) or from the United Nations Publications section at: <https://shop.un.org/books/global-harmon-syst-class-9-92280>.

11. GHS Pictogram for Hazard Category 1 Flammable Gases from Annex 1 to the 9<sup>th</sup> edition of the Global Harmonized System of Classification and Labelling of Chemicals, copyrighted 2021.

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4. 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 [Date of publication of the final rule in the Federal Register] Final Rule—Effective [30 days after date of publication of the final rule in the Federal Register]**

REFRIGERANTS—SUBSTITUTES ACCEPTABLE SUBJECT TO USE CONDITIONS

End-use	Substitute	Decision	Use Conditions	Further Information
1. Retail Food Refrigeration—Stand-alone units and refrigerated food processing and dispensing equipment (New only)	HFO-1234yf, HFO-1234ze(E), R-454C, R-455A, R-457A, and R-516A	Acceptable subject to use conditions	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). These substitutes may only be used in refrigeration equipment that meets all requirements in UL 60335-2-89. <sup>1,2,3</sup> In cases where this listing includes requirements more stringent than those of UL 60335-2-89, the appliance must meet	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

			<p>the requirements of this listing in place of the requirements in the UL Standard.</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 all requirements listed in ASHRAE 15-2022<sup>1,4,5</sup> and all addenda published as of [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]. 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 the ASHRAE Standard. 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>(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: a. At the top of the marking: “Minimum</p>	<p>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</p>
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			<p>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 m<sup>2</sup> (Z ft<sup>2</sup>)”. 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. 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>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.<sup>23</sup></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-</p>
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			<p>In addition to the markings described in Clauses 7.6 and 7.6DV D1 of UL 60335-2-89, the equipment must 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)<sup>1,7,8</sup> on the following three locations:</p> <ul style="list-style-type: none"> <li>• outside of the equipment (label (a));</li> <li>• 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</li> <li>• 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).</li> </ul> <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,<sup>1,4,6</sup> in letters at least one-third the height of the diamond symbol.</p>	270).
2. Retail Food Refrigeration —Refrigerated food processing and dispensing equipment (New only)	Propane (R-290)	Acceptable subject to use conditions	<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 substitute may only be used in refrigeration equipment that meets all requirements in UL 60335-2-89.<sup>1,2,3</sup> 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 in place of the requirements in the UL Standard.</p> <p>This refrigerant may be used in refrigerated food processing and dispensing equipment if and only if such equipment meets all requirements listed in ASHRAE 15-2022<sup>1,4,5</sup> and all addenda published as of <b>[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]</b>. In</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</p>

			<p>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 the requirements in the ASHRAE Standard. 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>(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>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</p>	<p>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.</p> <p>Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants</p>
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			<p>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 m<sup>2</sup> (Z ft<sup>2</sup>)”. 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 (1/4 inch) high.</p> <p>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>In addition to the markings described in Clauses 7.6 and 7.6DV D1 of UL 60335-2-89, the equipment must display the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) warning symbol for hazard category</p>	<p>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.<sup>2,3</sup></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 260-270).</p>
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			<p>1 flammable gases (black flame on a white background in a diamond with equal length sides with a red border)<sup>1,7,8</sup> on the following three locations:</p> <ul style="list-style-type: none"> <li>• outside of the equipment (label (a));</li> <li>• 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</li> <li>• 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).</li> </ul> <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,<sup>1,4,6</sup> in letters at least one-third the height of the diamond symbol.</p>	
<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>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 substitutes may only be used in refrigeration equipment that meets all requirements in UL 60335-2-89.<sup>1,2,3</sup> 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 in place of the requirements in the UL Standard.</p> <p>These refrigerants may be used in remote condensing units and supermarket systems if and only if such equipment meets all requirements listed in ASHRAE 15-2022<sup>1,4,5</sup> and all addenda published as of <b>[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]</b>. 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 the requirements in the ASHRAE Standard. Where similar</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</p>



			<p>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>(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 m<sup>2</sup> (Z ft<sup>2</sup>)”.</p>	<p>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.</p> <p>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</p>
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			<p>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 (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>In addition to the markings described in Clauses 7.6 and 7.6DV D1 of UL 60335-2-89, the equipment must 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)<sup>1,7,8</sup> on the following three locations:</p> <ul style="list-style-type: none"> <li>• outside of the equipment (label (a));</li> <li>• 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</li> <li>• in a location visible when accessing a</li> </ul>	<p>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.<sup>2,3</sup></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 260-270).</p>
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			<p>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> <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,<sup>1,4,6</sup> 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>	
4. Commercial Ice Machines (New only)	HFC-32, HFO-1234yf, R-454A, R-454B, 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.e., 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 refrigeration equipment that meets all requirements in UL 60335-2-89.<sup>1,2,3</sup> 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 in place of the requirements in the UL Standard.</p> <p>These refrigerants may be used in new commercial ice machines if and only if such equipment meets all requirements listed in ASHRAE 15-2022<sup>1,4,5</sup> and all addenda published as of <b>[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]</b>. 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 in place of the requirements in the ASHRAE Standard. 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), 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>(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 m<sup>2</sup> (Z ft<sup>2</sup>)”. 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</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.</p> <p>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</p>
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			<p>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 (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>In addition to the markings described in Clauses 7.6 and 7.6DV D1 of UL 60335-2-89, the equipment must 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)<sup>1,7,8</sup> on the following three locations:</p> <ul style="list-style-type: none"> <li>• outside of the equipment (label (a));</li> <li>• 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</li> <li>• 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).</li> </ul> <p>The perpendicular height of the diamond containing the GHS warning symbol for</p>	<p>and follow practices consistent with Annex 101.DVT of UL 260355-2-89.<sup>2,3</sup></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 machine appliances are likely to be hazardous waste under the Resource Conservation and Recovery Act (RCRA) (see 40 CFR parts 260-270).</p>
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			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, <sup>1,4,6</sup> in letters at least one-third the height of the diamond symbol.	
5. Industrial Process Refrigeration (New only)	HFO-1234yf, HFO-1234ze(E), R-454A, R-454B, 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.e., 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 refrigeration equipment that meets all requirements in UL 60335-2-89.<sup>1,2,3</sup> 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 in place of the requirements in the UL Standard.</p> <p>These refrigerants may be used in industrial process refrigeration equipment if and only if such equipment meets all requirements listed in ASHRAE 15-2022<sup>1,4,5</sup> and all addenda published as of <b>[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]</b>. 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 the ASHRAE Standard. 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>(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>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</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 m<sup>2</sup> (Z ft<sup>2</sup>)”. 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</p>	<p>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.<sup>2 3</sup></p> <p>CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants in the course of</p>
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			<p>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 (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>In addition to the markings described in Clauses 7.6 and 7.6DV D1 of UL 60335-2-89, the equipment must 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)<sup>1,7,8</sup> on the following three locations:</p> <ul style="list-style-type: none"> <li>• outside of the equipment (label (a));</li> <li>• 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</li> <li>• 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).</li> </ul> <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,<sup>1,4,6</sup> in letters at least one-third the height of the diamond symbol.</p> <p>The substitute R-454A may only be used</p>	<p>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 260-270).</p>
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			<p>in chillers for industrial process refrigeration, in equipment with a refrigerant charge capacity less than 200 pounds, or in the high-temperature side of a cascade system.</p> <p>The substitutes HFC-32 and R-454B may only be used in chillers for industrial process refrigeration.</p>	
6. 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.e., 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 refrigeration equipment that meets all requirements in UL 60335-2-89.<sup>1,2,3</sup> 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 in place of the requirements in the UL Standard.</p> <p>These refrigerants may be used in cold storage warehouses if and only if such equipment meets all requirements listed in ASHRAE 15-2022<sup>1,4,5</sup> and all addenda published as of <b>[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]</b>. 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 the ASHRAE Standard. 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>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.</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</p>

			<p>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 m<sup>2</sup> (Z ft<sup>2</sup>)”. 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</p>	<p>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.</p> <p>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.<sup>2,3</sup></p> <p>CAA section 608(c)(2) prohibits knowingly venting or otherwise knowingly releasing or disposing of substitute refrigerants</p>
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			<p>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 (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>In addition to the markings described in Clauses 7.6 and 7.6DV D1 of UL 60335-2-89, the equipment must 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)<sup>1,7,8</sup> on the following three locations:</p> <ul style="list-style-type: none"> <li>• outside of the equipment (label (a));</li> <li>• 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</li> <li>• 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).</li> </ul> <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<sup>1,4,6</sup>, 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</p>	<p>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 260-270).</p>
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			the high-temperature side of a cascade system.	
7. 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>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 substitutes may only be used in refrigeration equipment that meets all requirements in UL 60335-2-89.<sup>1 2 3</sup> 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 in place of the requirements in the UL Standard.</p> <p>These refrigerants may be used in ice skating rinks with remote compressors if and only if such equipment meets all requirements listed in ASHRAE 15-2022<sup>1,4,5</sup> and all addenda published as of <b>[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]</b>. 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 the ASHRAE Standard. 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</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</p>

			<p>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 m<sup>2</sup> (Z ft<sup>2</sup>)”. 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</p>	<p>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.<sup>2,3</sup></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>
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			<p>no less than 6.4 mm (1/4 inch) high.</p> <p>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>In addition to the markings described in Clauses 7.6 and 7.6DV D1 of UL 60335-2-89, the equipment must 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)<sup>1,7,8</sup> on the following three locations:</p> <ul style="list-style-type: none"> <li>• outside of the equipment (label (a));</li> <li>• 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</li> <li>• 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).</li> </ul> <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,<sup>1,4,6</sup> in letters at least one-third the height of the diamond symbol.</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 260-270).</p>
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<sup>1</sup> 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 U.S. EPA’s Air and Radiation Docket; EPA West Building, Room 3334, 1301 Constitution Ave., N.W., Washington DC or at the National Archives and Records Administration (NARA). For questions regarding access to these standards, the telephone number of EPA’s Air and Radiation Docket is 202-566-1742. For information on the availability of this material at NARA, call 202-741-6030, or go to: <https://www.archives.gov/federal-register/cfr/ibr-locations.html>.

<sup>2</sup> You may obtain the material from: COMM 2000; 151 Eastern Avenue; Bensenville, IL 60106;

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<sup>3</sup> UL 60335-2-89, Standard for Household and Similar Electrical Appliances - Safety - Part 2- 89: Particular Requirements for Commercial Refrigerating Appliances, 2nd edition, Dated October 27, 2021.

<sup>4</sup> You may obtain this material from: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), 180 Technology Parkway NW, Peachtree Corners, Georgia 30092; 1-800-527-4723 in the U.S. or Canada; by email at [store@techstreet.com](mailto:store@techstreet.com); or online at [https://www.techstreet.com/ashrae/ashrae\\_standards.html?ashrae\\_auth\\_token=](https://www.techstreet.com/ashrae/ashrae_standards.html?ashrae_auth_token=).

<sup>5</sup> American National Standards Institute /American Society of Heating, Refrigerating and Air Conditioning Engineers (ANSI/ASHRAE) Standard 15-2022. Safety Standard for Refrigeration Systems, Copyright 2022, including the following addenda to ANSI/ASHRAE Standard 15-2022, Safety Standard for Refrigeration Systems, as published by **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]** :

<sup>6</sup> American National Standards Institute /American Society of Heating, Refrigerating and Air Conditioning Engineers (ANSI/ASHRAE) Standard 34-2022. Designation and Safety Classification of Refrigerants. Copyright 2022.

<sup>7</sup> You may obtain this material from: [https://unece.org/sites/default/files/2021-9/GHS\\_Rev9E\\_0.pdf](https://unece.org/sites/default/files/2021-9/GHS_Rev9E_0.pdf) or from the United Nations Publications section at: <https://shop.un.org/books/global-harmon-syst-class-9-92280>.

<sup>8</sup> GHS Pictogram for Hazard Category 1 Flammable Gases from Annex 1 to the 9<sup>th</sup> edition of the Global Harmonized System of Classification and Labelling of Chemicals, copyrighted 2021.

In §82.154 is amended 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; effective January 3, 2017, self-contained commercial ice machines, very low temperature refrigeration equipment, and water coolers; and effective **[30 DAYS AFTER PUBLICATION OF FINAL RULE IN THE FEDERAL REGISTER]**, retail food refrigeration—refrigerated food processing and dispensing equipment.

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