

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 82

[EPA-HQ-OAR-2009-0286; FRL-xxxx-x]

RIN 2060-AP54

**Protection of Stratospheric Ozone: Listing of Substitutes for Ozone-Depleting
Substances – Hydrocarbon Refrigerants**

AGENCY: Environmental Protection Agency [EPA].

ACTION: Proposed Rulemaking.

SUMMARY: Pursuant to the U.S. Environmental Protection Agency’s Significant New Alternatives Policy program, this action proposes to list isobutane, propane, HCR-188C, and HCR-188C1 as “acceptable, subject to use conditions,” as substitutes for chlorofluorocarbon (CFC)-12, also referred to as R-12, CCl₂F₂ and dichlorodifluoromethane: and hydrochlorofluorocarbon (HCFC)-22, also referred to as R-22, CHClF₂, chlorodifluoromethane and difluorochloromethane, in: household refrigerators, freezers, and combination refrigerator and freezers and commercial refrigeration (retail food refrigerators and freezers - stand-alone units only).

DATES: Comments must be received on or before **[INSERT DATE 60 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER]**, unless a public hearing is requested.

Comments must then be received on or before **[INSERT DATE 75 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 10 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER.]** If a hearing is held, it will take place on **[INSERT 15 DAYS AFTER PUBLICATION]** in Washington, D.C. and further information will be provided on EPA's Stratospheric Ozone World Wide Web site at www.epa.gov/ozone/snap.

ADDRESSES: Submit your comments, identified by Docket ID No. EPA-HQ-OAR-2009-0286, by one of the following methods:

- <http://www.regulations.gov>. Follow the on-line instructions for submitting comments.
- E-mail: A-And-R-Docket@epa.gov
- Mail: Air and Radiation Docket, Environmental Protection Agency, Mailcode 6102T, 1200 Pennsylvania Ave., NW, Washington, DC, 20460, Attention Docket ID No. EPA-HQ-OAR-2009-0286.
- Hand Delivery: EPA Docket Center, (EPA/DC) EPA West, Room 3334, 1301 Constitution Ave., NW, Washington, D.C., Attention Docket ID No. EPA-HQ-OAR-2009-0286. Such deliveries are only accepted during the Docket's normal hours of operation, and special arrangements should be made for deliveries of boxed information.

Instructions: Direct your comments to Docket ID No. EPA-HQ-OAR-2009-0286. EPA's policy is that all comments received will be included in the public docket without change and may be made available online at www.regulations.gov, including any personal information provided, unless the comment includes information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through www.regulations.gov or e-mail. The www.regulations.gov website is an "anonymous access" system, which means EPA will not know your identity or contact information unless you provide it in the body of your

comment. If you send an e-mail comment directly to EPA without going through www.regulations.gov, your e-mail address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD-ROM you submit. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses. For additional instructions on submitting comments, go to Section I.B. of the **SUPPLEMENTARY INFORMATION** section of this document.

Docket: All documents in the docket are listed in the www.regulations.gov index. Although listed in the index, some information is not publicly available, i.e., 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 either electronically in www.regulations.gov or in hard copy at the Air and Radiation Docket, EPA/DC, EPA West, Room 3334, 1301 Constitution Ave., NW, Washington, DC. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566-1744, and the telephone number for the Air and Radiation Docket is (202) 566-1742.

FOR FURTHER INFORMATION CONTACT: Monica Shimamura, Stratospheric Protection Division, Office of Atmospheric Programs, Mail Code 6205J, Environmental Protection Agency, 1200 Pennsylvania Ave., NW, Washington, DC 20460; telephone number

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Notices and rulemakings under EPA's Significant New Alternatives Policy (SNAP) program are available on EPA's Stratospheric Ozone World Wide Web site at www.epa.gov/ozone/snap/regs.

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I. General Information

A. Background

This rule pertains to four hydrocarbon refrigerants: isobutane, propane and HCR-188C and HCR-188C1. Globally, hydrocarbon refrigerants have been in use for over 10 years including in countries such as Germany, the United Kingdom, Australia, and Japan. In Europe and Asia, equipment manufactures have designed and tested household and commercial refrigerators and freezers to account flammability and safety concerns associated with using hydrocarbon refrigerants. Due to the fact that hydrocarbon refrigerants have zero ozone depletion potential (ODP) and very low global warming potential (GWP), many companies are interested in using hydrocarbon refrigerants in the United States (U.S.) as well. In this action EPA has received four SNAP submissions for use of hydrocarbon refrigerants in household

refrigerators, freezers, combination refrigerator and freezers and retail food refrigerators and freezers (stand-alone only).

B. Does this action apply to me?

This notice of proposed rulemaking (NPRM) would regulate the use of four alternative refrigerants used in: household refrigerators and freezers and commercial refrigeration (retail food refrigeration – stand-alone units only).¹ Potentially entities that may wish to use isobutane (R-600a), propane (R-290), HCR-188C, or HCR-188C1 in these end-uses, include:

Table 1–Potentially Regulated Entities, by North American Industrial Classification System (NAICS) Code or Subsector

Category	NAICS code or subsector	Description of regulated entities
Industry	333415	Manufactures of refrigerators, freezers, and other refrigerating or freezing equipment, electric or other; heat pumps not elsewhere specified or included (NESOI); and parts thereof
Industry	443111	Appliance Stores: Household-type
Industry	445120	Convenience Stores
Industry	445110	Supermarkets and Other Grocery (except Convenience) Stores
Industry	722211	Limited-Service Restaurants
Industry	238220	Plumbing, Heating, and Air Conditioning Contractors
Industry	811412	Appliance Repair and Maintenance
Industry	541380	Environmental Testing Laboratories
Industry	423620	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers
Industry	423740	Refrigeration Equipment and Supplies Merchant Wholesalers

¹ HCR-188C and HCR-188C1 submissions included window air conditioners as an end use. EPA is acting on this end use in a separate rule making.

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

C. What should I consider as I prepare my comments for EPA?

1. *Submitting Confidential Business Information (CBI).* Do not submit confidential information to EPA through www.regulations.gov or e-mail. Clearly mark the part or all of the information that you claim to be CBI. For CBI information in a disk or CD ROM that you mail to EPA, mark the outside of the disk or CD ROM as CBI and then identify electronically within the disk or CD ROM the specific information that is claimed as CBI. In addition to one complete version of the comment that includes information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public docket. Information marked as CBI will not be disclosed except in accordance with procedures set forth in 40 Code of Federal Regulations (CFR) Part 2.

2. *Tips for Preparing Your Comments.*

When submitting comments, remember to:

- Identify the rulemaking by docket number and other identifying information (subject heading, Federal Register date, and page number).
- Follow directions - The agency may ask you to respond to specific questions or organize comments by referencing a CFR part or section number.

- Explain why you agree or disagree; suggest alternatives and substitute language for your requested changes.
- Describe any assumptions and provide any technical information and/or data that you used.
- If you estimate potential costs or burdens, explain how you arrived at your estimate in sufficient detail to allow for it to be reproduced.
- Provide specific examples to illustrate your concerns, and suggest alternatives.
- Explain your views as clearly as possible, avoiding the use of profanity or personal threats.
- Make sure to submit your comments by the comment period deadline identified.

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

Below is a list of acronyms and abbreviations used in the preamble of this NPRM.

ACH—air changes per hour

AEGL—acute Exposure Guideline Level

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

ANSI—American National Standards Institute

CAA —Clean Air Act

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

CBI—Confidential Business Information

CFC—chlorofluorocarbon

cfm—cubic feet per minute

CFR—Code of Federal Regulations

EPA–the United States Environmental Protection Agency

FR–Federal Register

GWP–global warming potential

HC–hydrocarbon

HCFC–hydrochlorofluorocarbon

HFC–hydrofluorocarbon

ICF–ICF International, Inc.

IDLH–Immediately dangerous to life or health

ICR–Information Collection Request

LFL–lower flammability limit

mg/l–milligrams per liter

MSDS–Material Safety Data Sheet

NAICS–North American Industrial Classification System

NIOSH–the U.S. National Institute for Occupational Safety and Health

NPRM–Notice of Proposed Rulemaking

OEM–original equipment manufacturer

ODP–ozone depletion potential

ODS–ozone-depleting substance

OMB–the United States Office of Management and Budget

OSHA–the United States Occupational Safety and Health Administration

PELs –permissible exposure limits

ppm–parts per million

REL –Recommended exposure limit

RFA–Regulatory Flexibility Act

RfC–reference concentration

SNAP–Significant New Alternatives Policy

TSCA–Toxic Substances Control Act

TWA –time weighted average

UL–Underwriters Laboratories Inc.

VOC–volatile organic compound

II. How does the Significant New Alternatives Policy (SNAP) program work?

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

Section 612 of the Clean Air Act (CAA) requires EPA to develop a program for evaluating alternatives to ozone-depleting substances (ODS). EPA refers to this program as the Significant New Alternatives Policy (SNAP) program. The major provisions of section 612 are:

1. Rulemaking

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

2. Listing of Unacceptable/Acceptable Substitutes

Section 612(c) requires EPA to publish a list of the substitutes unacceptable for specific

uses and to publish a corresponding list of acceptable alternatives for specific uses. The list of acceptable substitutes is found at <http://www.epa.gov/Ozone/snap/lists/index.html> and the lists of “unacceptable”, “acceptable subject to use conditions”, and “acceptable subject to narrowed use limits” is found at 40 CFR part 82 subpart G.

3. Petition Process

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

4. 90-day Notification

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

5. Outreach

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

6. Clearinghouse

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

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

On March 18, 1994, EPA published the original rulemaking (59 FR 13044) which established the process for administering the SNAP program and issued EPA's first lists identifying acceptable and unacceptable substitutes in the major industrial use sectors (40 CFR part 82, subpart G). These sectors include: refrigeration and air conditioning; foam blowing; cleaning solvents; fire suppression and explosion protection; sterilants; aerosols; adhesives, coatings and inks; and tobacco expansion. These sectors compose the principal industrial sectors that historically consumed the largest volumes of ODS.

Section 612 of the CAA requires EPA to ensure that substitutes found acceptable do not prevent a significantly greater risk to human health and the environment as compared with other substitutes that are currently or potentially available.

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

Under the SNAP regulations, anyone who plans to market or produce a substitute for class I or II ODS in one of the eight major industrial use sectors must provide the Agency with health and safety studies on the substitute at least 90 days before introducing it into interstate commerce for significant new use as an alternative. This requirement applies to the person planning to introduce the substitute into interstate commerce,² typically chemical manufacturers,

² As defined at 40 CFR 82.104 "interstate commerce" means the distribution or transportation of any product between one state, territory, possession or the District of Columbia, and another state, territory, possession or the District of Columbia, or the sale, use or manufacture of any product in more than one state, territory, possession or District of Columbia. The entry points for which a product is introduced into interstate commerce are the release of a product from the facility in which the product was manufactured, the entry into a warehouse from which the domestic manufacturer releases the product for sale or distribution, and at the site of United States Customs clearance.

but may also include importers, formulators, equipment manufacturers, or end-users³ when they are responsible for introducing a substitute into commerce. In this proposed rule we are addressing SNAP submissions from three companies interested in introducing into interstate commerce products that contain hydrocarbon refrigerants.

The Agency has identified four possible decision categories for substitutes: acceptable; acceptable subject to use conditions; acceptable subject to narrowed use limits; and unacceptable. Use conditions and narrowed use limits are both considered “use restrictions” and are explained below. 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 within the sector. Substitutes that are acceptable subject to use restrictions may be used only in accordance with those restrictions. It is illegal to replace an ODS with a substitute listed as unacceptable, unless certain exceptions (e.g. test marketing, research and development) provided by the regulation are met.

After reviewing a substitute, the Agency may make a determination 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." Entities that use these substitutes without meeting the associated use conditions are in violation of section 612 of the Clean Air Act.

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. The Agency requires a user of a narrowed use substitute to demonstrate that no other acceptable substitutes are available for their specific

³ As defined at 40 CFR 82.17 “end-use” means processes or classes of specific applications within major industrial sectors where a substitute is used to replace an ozone-depleting substance.

application by conducting comprehensive studies. EPA describes these substitutes as “acceptable subject to narrowed use limits.” A person using a substitute that is acceptable subject to narrowed use limits in applications and end-uses that are not consistent with the narrowed use limit, are using these substitutes in an unacceptable manner and are in violation of section 612 of the Clean Air Act.

The Agency publishes its SNAP program decisions in the Federal Register (FR). EPA publishes decisions concerning substitutes that are deemed acceptable subject to use restrictions (use conditions and/or narrowed use limits), or for substitutes deemed unacceptable, as proposed rulemakings to allow the public opportunity to comment, before publishing final decisions.

In contrast, EPA publishes substitutes that are deemed acceptable with no restrictions in “notices of acceptability,” rather than as proposed and final rules. As described in the rule initially implementing the SNAP program (59 FR 13044), EPA does not believe that rulemaking procedures are necessary to list alternatives that are acceptable without restrictions because such listings neither impose any sanction nor prevent anyone from using a substitute.

Many SNAP listings include “comments” or “further information” to provide additional information on substitutes. Since this additional information is not part of the regulatory decision, these statements are not binding for use of the substitute under the SNAP program. However, regulatory requirements so listed are binding under other regulatory programs. 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 comments, if adopted, would not require the affected user to make significant changes in existing operating practices.

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

For copies of the comprehensive SNAP lists of substitutes or additional information on SNAP, refer to EPA's Ozone Depletion web site at www.epa.gov/ozone/snap/index.html. For more information on the Agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the SNAP final rulemaking published March 18, 1994 (59 FR 13044), codified at 40 CFR part 82, subpart G. A complete chronology of SNAP decisions and the appropriate citations are found at <http://www.epa.gov/ozone/snap/chron.html>.

III. What substitutes for ozone-depleting substances in what end-uses are considered in this rule?

A. What is EPA proposing in this action?

In this action, EPA proposes to list the following:

(1) Isobutane, also referred to by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) refrigerant designation R-600a, and the proprietary hydrocarbon blends HCR-188C and HCR-188C1, as acceptable subject to use conditions as a substitute for CFC-12⁴ in household refrigerators, freezers, and combination refrigerator and freezers. EPA proposes the following use conditions:

⁴ CFC-12 is also referred to as R-12, CCl₂F₂ and dichlorodifluoromethane. Its CAS Reg. No. is 75-71-8.

1. The quantity of the substitute refrigerant (i.e., “charge size”) shall not exceed 57 grams (2.0 ounces) in any refrigerator, freezer, or combination refrigerator and freezers;
2. 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);
3. These refrigerants may be used only in refrigerators or freezers or combination refrigerator and freezers that meet all requirements listed in the 10th edition of Underwriters Laboratory (UL) Standard 250. In cases where the final rule includes requirements more stringent than those of the 10th edition of UL Standard 250, the appliance must meet the requirements of the final rule in place of the requirements in the UL Standard;
4. The refrigerator, freezer, or combination refrigerator and freezer 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 where service puncturing or otherwise 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;
5. Similar to clauses SA6.1.1 to SA6.1.2 of UL standard 250, the following markings, or the equivalent, shall be provided and shall be permanent:

- a) "DANGER- Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing."
- b) "DANGER- Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing."
- 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."
- d) "CAUTION - Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used."
- e) "CAUTION - Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used."

The marking described in clause (a) above shall be permanently attached on or near any evaporators that can be contacted by the consumer. The markings described in clauses (b) and (c) above shall be permanently attached near the machine compartment. The markings described in clause (d) above shall be permanently attached on the exterior of the refrigerator. The marking described in clause (e) above shall be permanently attached near any and all exposed refrigerant tubing. All of these markings shall be in letters no less than 6.4 mm (1/4 inch) high.

6. Household refrigerators, freezers, and combination refrigerator and freezers using these refrigerants must have service aperture fittings that are colored red as described

above in use condition number four and which differ from fittings used in equipment or containers using non-flammable refrigerant. “Differ” means that either that the diameter must differ by at least 1/16 inch or the thread direction must be reversed (i.e., right handed vs. left handed). These different fittings must be permanently affixed to the unit and may not be accessed with an adaptor until the end-of-life of the unit;

7. These refrigerants may not be sold for use as a refrigerant in containers designed to contain less than five pounds (2.8 kg) of refrigerant.

(2) Propane, R-290,⁵ as acceptable subject to use conditions as a substitute for CFC-12, R-502, or HCFC-22, in retail food refrigerators and freezers:

1. The charge size for the retail food refrigerator or freezer using R-290 shall not exceed 150 grams (5.3 ounces);
2. This refrigerant may be used only in new equipment specifically designed and clearly identified for the refrigerant;
3. This substitute may only be used in equipment that meets all requirements in the 9th edition of UL Standard 471. In cases where the final rule includes requirements more stringent than those of the 9th edition of UL Standard 471, the appliance must meet the requirements of the final rule in place of the requirements in the UL Standard;
4. The refrigerator or freezer must have red, Pantone Matching System (PMS) #185 marked pipes, hoses, and 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 where service

⁵ Propane is also known as R-290, HC-290, CH₃CH₂CH₃ and C₃H₈. Its CAS Reg. No. is 74-98-6.

puncturing or otherwise 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;

5. Similar to clauses SB6.1.2 to SB6.1.5 of UL Standard 471, the following markings, or the equivalent, shall be provided and shall be permanent:

- a) "DANGER- Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing."
- b) "DANGER- Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing."
- 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."
- d) "CAUTION - Risk of Fire or Explosion. Dispose of Property In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used."
- e) "CAUTION - Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used."
This marking shall be provided near all exposed refrigerant tubing.

The marking described in clause (a) above shall be permanently attached or near any evaporators that can be contacted by the consumer. The markings described in clauses (b) and (c) above shall be located near the machine compartment. The marking

described in clause (d) above shall be permanently attached on the exterior of the refrigerator. The marking described in clause (e) above shall be permanently attached near any and all exposed refrigerant tubing. All of these markings shall be in letters no less than 6.4 mm (1/4 inch) high.

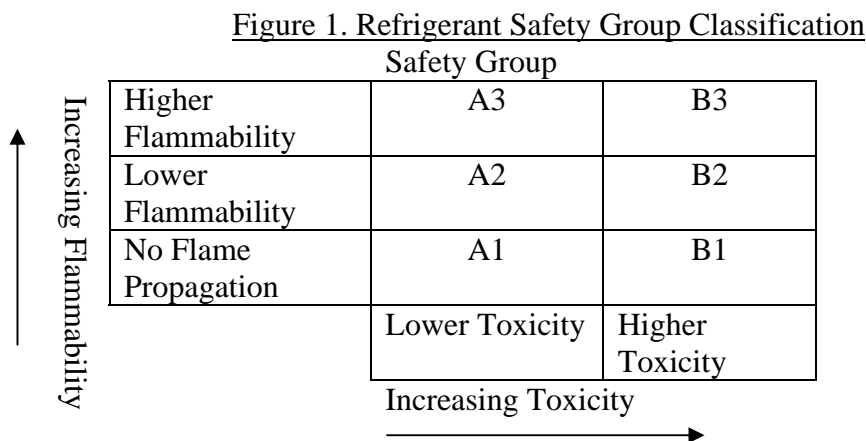
6. Retail food refrigeration using R-290 must have fittings that are colored red as described above in use condition number four and which differ from fittings used in equipment or containers using non-flammable refrigerant. "Differ" means that either that the diameter must differ by at least 1/16 inch or the thread direction must be reversed (i.e., right handed vs. left handed). These fittings must be permanently affixed to the unit, and may not be accessed with an adaptor, until the end-of-life of the unit;
7. R-290 may not be sold as a refrigerant in containers containing less than five pounds (2.8 kg) of refrigerant.

B. What are isobutane, propane, HCR-188C, and HCR-188C1?

Hydrocarbons are flammable organic compounds made up of hydrogen and carbon.

Isobutane has four carbons while propane has three carbons. HCR-188C and HCR-188C1 are proprietary blends consisting of primarily or exclusively of hydrocarbons. The chemical formula for isobutane, also called 2-methylpropane, is C_4H_{10} , also written as $CH(CH_3)_2-CH_3$ to distinguish it from butane. Isobutane's identification number in the Chemical Abstracts Service's registry (CAS Reg. No.) is 75-28-5. The chemical formula for propane is C_3H_8 and its CAS Reg. No. is 74-98-6. As refrigerants, propane and isobutane can be referred to by the ASHRAE designations R-290 and R-600a, respectively.

ANSI/ASHRAE Standard 34-2007 categorizes isobutane, propane, and components of HCR-188C and HCR-188C1 in the A3 Safety Group. ASHRAE’s safety group classification consists of two alphanumeric characters (e.g., A2 or B1). The capital letter indicates the toxicity and the numeral denotes the flammability. ASHRAE classifies Class A refrigerants as refrigerants for which toxicity has not been identified at concentrations less than or equal to 400 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 then assigned a flammability classification from one of three classes – 1, 2, or 3 based on flammability. Tests are conducted in accordance with ASTM E681 using a spark ignition source (ASHRAE 2007). Figure 1 in ANSI/ASHRAE Standard 15-2007 uses the same safety group but limits its concentration to 3400 ppm.



C. What end-uses are included in our proposed decision?

1. Household refrigerators, freezers, and combination refrigerator and freezers

Household refrigerators, freezers, and combination refrigerator and freezers are intended primarily for residential use, although they may be used outside the home. Household freezers only offer storage space at freezing temperatures, unlike household refrigerators. Products with both a refrigerator and freezer in a single unit are most common. In this NPRM, EPA is limiting the scope of our acceptability decisions to refrigerators and freezers and combination refrigerator and freezers with a refrigerant charge of 57 grams (2.0 ounces) or less.

2. Retail Food Refrigeration

Retail food refrigeration includes the refrigeration systems, including cold storage cases, designed to chill food or keep it at a cold temperature for commercial sale. For the purpose of this proposal we are considering the use of hydrocarbons only in stand-alone equipment. A stand-alone appliance is one utilizing a sealed hermetic compressor and for which all refrigerant-containing components, including but not limited to the compressor, condenser and evaporator, are assembled into a single piece of equipment before delivery to the ultimate consumer or user, such equipment not requiring the addition or removal of refrigerant when placed into initial operation. Stand-alone equipment is used to store chilled beverages or frozen products (e.g., reach-in beverage coolers and stand-alone ice cream cabinets). This proposed decision does not apply to large refrigeration systems such, as but not limited to, direct expansion refrigeration systems typically found in retail food stores. We are proposing as a use condition that stand-alone equipment using a hydrocarbon refrigerant have a refrigerant charge less than 150 grams (5.3 ounces).

D. Where can I find the regulatory text for these proposed listing decisions?

Our proposed decisions appear in a table at the end of the document and if finalized will be codified at 40 CFR 82 subpart G. The proposed regulatory text contains proposed listing decisions for the above end-uses. EPA is proposing to find isobutane, propane, HCR-188C, and HCR-188C1 acceptable with use conditions. We note that there may be other legal obligations pertaining to the manufacture, use, handling, and disposal of hydrocarbons that are not included in the information listed in the tables (e.g., section 608 prohibition on venting refrigerant or Department of Transport requirements for transport of flammable gases).

E. What does an acceptability determination with use conditions for isobutane, propane, HCR-188C, and HCR-188C1 mean?

In this action, EPA is proposing to find isobutane, propane, HCR-188C, and HCR-188C1 acceptable subject to use conditions as substitutes for CFC-12, HCFC-22, and R-502 in certain refrigeration end-uses. If this proposal were to become final, it would be legal to use isobutane, propane, HCR-188C, and HCR-188C1 in the specified types of equipment under the conditions outlined above as a substitute for ozone-depleting substances (ODS). If this proposal became final, use in the specified types of equipment that is not consistent with the use conditions would be a violation of CAA section 612 and EPA's implementing regulations.

EPA seeks comment regarding this proposal and, in particular, whether the proposed use conditions are adequate to ensure the safe and appropriate handling of hydrocarbon refrigerants.

IV. What criteria did EPA consider in preparing this proposal?

Section 612(c) of the Clean Air Act directs EPA to publish a list of acceptable replacement substances (“substitutes”) for class I and class II ODS, where the Administrator determines they are safe for specific uses when compared with other currently or potentially available substitutes, and a list of prohibited substitutes for specific uses. EPA compares the risks to human health and the environment of a substitute to the risks associated with other substitutes that are currently or potentially available. EPA also considers whether the substitute for class I and class II ODSs “reduces the overall risk to human health and the environment” compared to the ODSs historically used in the end use. The criteria for review are listed at 40 C.F.R. 82.180 (a) (7). These criteria are (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.

EPA evaluated each of the criteria separately and then considered overall risk to human health and the environment in comparison to other available or potentially available alternatives in the same end-uses. EPA proposes to conclude that, overall, environmental risks posed by the four reviewed substitutes were not greater than the environmental risks posed by other substitutes in the reviewed end-uses. Because these four substitutes have zero ozone depletion potential (ODP), very low global warming potential (GWP), and are volatile organic compounds (VOCs) but insignificantly affect local air quality, the environmental risks associated with ODP, GWP, and VOC effects are lower than or comparable to other acceptable substitutes. These and other environmental risks are discussed below. In addition, EPA has placed in the docket an analysis table comparing the four substitutes being proposed in this action and several substitutes that have been found acceptable in the refrigeration and air conditioning end use. The

flammability risks to public health are of concern because household and retail food refrigerators and freezers have traditionally used refrigerants that are not flammable. Without mitigation, the risks posed by these refrigerants would be higher than other non-flammable refrigerants because individuals may not be aware that their actions could potentially cause a fire, and existing equipment has not been designed specifically to minimize flammable risks. Therefore, EPA is proposing use conditions to mitigate these risks to ensure that the overall risk to human health and the environment posed by these four substitutes is not greater than the overall risk posed by other substitutes in the same end use.

A. Impacts on the ecosystem

This section will include the substitutes' impact on the environment including ODP, GWP, and VOC. The ODP is the ratio of the impact on stratospheric ozone of a chemical compared to the impact of an identical mass of CFC-11. Thus, the ODP of CFC-11 is defined to be one (1.0). Other CFCs and HCFCs have ODPs that range from 0.01 to one (1.0). All four refrigerant substitutes in this proposal have an ODP of zero,⁶ lower than the ODP of the substances that they would replace: CFC-12 (ODP = 1.0); HCFC-22 (ODP = 0.055); and R-502 (ODP = 0.334) (WMO, 2006). The most commonly used substitutes in these two end-uses also have an ODP of zero (e.g. R-404A, R-134a, R-410A, R-407C).

The GWP index is a means of quantifying the potential integrated climate forcing of various greenhouse gases relative to carbon dioxide. The 100-year integrated GWPs of isobutane, propane, HCR-188C, and HCR-188C1 are estimated to be eight, three, less than five, and less than five respectively, compared to a value of one for CO₂ (WMO, 2006). These are

⁶ CFCs and HCFCs are examples of ozone-depleting compounds unlike HCs which contain no chlorine. CFCs and HCFCs bring chlorine to the stratosphere, which cause depletion of the ozone layer.

significantly lower than the 100-year integrated GWPs of the substances that they would be replacing: CFC-12 (GWP = 10,890); HCFC-22 (GWP = 1,810); and R-502 (GWP = 4,660) (WMO, 2006). The GWPs for hydrocarbons (including the four being reviewed here) are minimal and are significantly lower than those of other acceptable refrigerants in these end-uses (e.g. GWPs of R-134a, R-404A, R-407C, and R-410A are about 1430, 3920, 1770, and 2090 respectively).

The greenhouse gas (GHG) impacts of these refrigerants also depend upon the energy use by appliances, since the “indirect” GHG emissions associated with electricity consumption typically exceed those from refrigerants over the full lifecycle of refrigerant-containing products. (Citation: J. Sand, S. Fischer, and V. Baxter, “Energy and Global Warming Impacts of HFC Refrigerants and Emerging Technologies,” 1997, Oak Ridge National Lab) If hydrocarbon-using appliances are less energy efficient than the appliances they replace, then it is possible that these appliances will result in higher lifecycle greenhouse gas emissions even if refrigerant emissions are lower. Conversely, higher energy efficiency of these appliances would lead to lower GHG emissions than the reduction from refrigerants alone. We have not quantified the full lifecycle GHG emissions associated with substituting traditional ODS refrigerants with hydrocarbons but acknowledge that they also depend on the appliance’s electricity consumption and the fuel used to generate that electricity.

Hydrocarbons are VOCs under CAA regulations addressing the development of State Implementation Plans to attain and maintain National Ambient Air Quality Standards for ground-level ozone, which is a respiratory irritant (see 40 CFR 51.100(s)). Potential emissions of VOCs from all substitutes for all end-uses in the refrigeration and air conditioning sector are estimated

to be insignificant relative to VOCs from all other sources (i.e., other industries, mobile sources, and biogenic sources) (ICF, May 22, 2009, May 26, 2009, and July 17, 2009).

B. Flammability and fire safety

Due to their flammable nature, isobutane, propane, HCR-188C, and HCR-188C1 could pose a significant safety concern for workers and consumers if they are not handled correctly. In the presence of an ignition source (e.g., static electricity spark resulting from closing a door, using a torch during service, or a short circuit in wiring that controls the motor of a compressor), an explosion or a fire could occur when the concentration of isobutane, propane, HCR-188C or HCR-188C1 exceeds its lower flammability limit⁷ (LFL) of 18,000 ppm, 21,000 ppm, 20,000 ppm, or 16,000 ppm, respectively. Therefore, in order for these substitutes to be used safely, it is important to minimize the presence of potential ignition sources and to reduce the likelihood that the levels of isobutane, propane, HCR-188C, or HCR-188C1 will exceed the LFL. In production facilities or other facilities where large quantities of the refrigerant would be stored, proper safety precautions should be in place to minimize the risk of explosion. EPA recommends these facilities be equipped with proper ventilation systems to minimize the risks of explosion and should be properly designed to reduce possible ignition sources. EPA also understands that these hydrocarbon refrigerants will be used by original equipment manufacturers (OEMs) in specifically redesign refrigerators and freezers.

For all four hydrocarbon refrigerants considered in this proposal, to determine whether flammability would be a concern for service and manufacture personnel or for consumers, EPA conducted a reasonable worst-case scenario analysis to model catastrophic release of the

⁷ Lower flammability limit (LFL) = Lower Flammability Limit, the minimum concentration in air at which flame propagation occurs

refrigerant. The worst-case scenario analyses revealed that even if the unit's full charge is emitted within one minute, none of these four hydrocarbons reached the LFL (ICF, May 22, 2009, May 26, 2009, July 17, 2009, and November 6, 2009). However as mentioned above, hydrocarbons refrigerants are flammable and service and manufacture personnel or consumers are not familiar with these refrigerator or freezer or combination refrigerators and freezers containing a flammable refrigerant; therefore, use conditions are necessary to create awareness of a flammable refrigerant and ensure safe handling. Detailed analysis of the modeling results are discussed below in the "toxicity" section of the preamble. EPA also reviewed the submitters' detailed assessments of the probability of events that might create a fire and engineering approaches to avoid sparking from the refrigeration equipment.

C. Toxicity

In evaluating potential human health impacts of isobutane, propane, HCR-188C, and HCR-188C1, EPA considered impacts both on exposed manufacture personnel, store employees, technicians herein defined as "worker," and on consumers. EPA investigated the risk of asphyxiation and of exposure to toxic levels of refrigerant for a worst-case scenario and a typical use scenario for isobutane, propane, HCR-188C, and HCR-188C1. EPA believes that the use of any of these hydrocarbons in the end-uses reviewed does not pose a significant risk of asphyxiation or of exposure to toxic levels to workers or consumers.

EPA estimated the maximum time weighted average⁸ (TWA) exposure for each exposure scenario and compared this value to relevant industry and government exposure limits for isobutane, propane, HCR-188C, and HCR-188C1 (including potential impurities in the

⁸ Time weighted average (TWA) = An allowable exposure concentration averaged over a normal 8-hour workday or a 40-hour workweek.

substitutes). The modeling results indicate that both the short-term (15-minute and 30-minute) and long-term (8-hour) worker exposure concentrations at no point are likely to exceed 2 percent (for isobutane), 50 percent (for propane), 4 percent (for HCR-188C), or 2 percent (for HCR-188C1) of the Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) and National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL) of the component refrigerants (for isobutane and propane) or the refrigerants components for HCR-188C and HCR-188C1 (ICF, 2009).

EPA performed a consumer exposure analysis that examined potential catastrophic release of the substitute under a reasonable worst-case scenario. Estimates for acute/short-term consumer exposures resulting from catastrophic leakage of refrigerant from residential refrigerators were examined. The analysis was undertaken to determine the 15-minute and 30-minute TWA exposure levels for the substitute, which were then compared to the standard toxicity limits to assess the risk to consumers. However, the TWA values were conservative, as the analysis did not consider opened windows, fans operating, conditioned airflow (either heated or cooled), and other variables that would likely reduce the levels to which individuals would be exposed.

This analysis assumed that 100 percent of the unit's charge would be released during a time span of one minute, at which time the concentration of refrigerant would peak and then steadily decline. Refrigerant concentrations were modeled under two air change scenarios, believed to represent the baseline of potential flow rates for a home, assuming flow rates of 2.5 and 4.5 air changes per hour (ACH) (Sheldon 1989). The highest concentrations of the refrigerant occur in the lower stratum of the room when assuming lower ventilation levels of 2.5 ACH. Using a 2.5 ACH to calculate the TWA achieves a higher concentration than using 4.5

ACH to calculate the TWA. Because EPA looked at the worst case scenario it was only necessary to evaluate the TWA values using 2.5 ACH as 4.5 ACH TWA values would be in the acceptable range if the 2.5ACH TWA values were within the acceptable range.

OSHA (2004) states no toxic effects are reported with exposures to isobutane below 18,000 ppm. Even under the very conservative assumptions used in the consumer exposure modeling, both the estimated 15-minute and 30-minute consumer exposures to isobutane (5,025 ppm and 3,844 ppm, respectively) are much lower than 18,000 ppm, and thus should not pose a toxicity threat.

EPA also evaluated the same scenario with HCR-188C and HCR-188C1. The highest concentrations of HCR-188C and HCR-188C1 occur in the lower stratum of the room when assuming lower ventilation levels of 2.5 ACH. Even under the conservative assumptions used in the consumer exposure modeling, both the estimated 15-minute and 30-minute consumer exposure levels of HCR-188C and HCR-188C1 are at least 50 percent lower than the 30-minute acute exposure guideline level (AEGL)-1 values for the individual components of the blend and thus should not pose a toxicity threat.

To assess end-use exposures to propane, an Acute Exposure Guideline Level (AEGL) was chosen as the most appropriate toxicological limit. This limit is an emergency guideline for exposures to the general population (including susceptible populations) and is not time-weighted; it also considers the chemical's flammability in addition to its toxicity. A time-weighted limit was deemed inappropriate for this scenario because, due to the nature of a time-weighted calculation. As TWA are exposure concentrations averaged over a normal eight (8) hour work-day, it could allow a room occupant to be exposed to levels higher than the limit for a brief

period of time. This is a concern for propane due to its flammability, as a higher exposure could approach the chemical's lower flammability limit (LFL - propane has an LFL of 21,000 ppm).

The EPA develops a set of AEGL values for a chemical for five exposure periods (10 and 30 minutes, 1 hour, 4 hours and 8 hours). For each exposure period, three different AEGL values are developed to address different levels of toxicological impacts. Of relevance for the modeled scenario is the AEGL-1 (10,000 ppm), which is defined as: "the airborne concentration, expressed as parts per million or milligrams per cubic meter (ppm or mg/m³) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure." While permanent toxicological effects are not expected up to the AEGL-2 value (17,000 ppm for propane), this limit is not relevant for this analysis because at that level, flammability would be a greater concern.

EPA analyzed consumer and worker exposure to propane in commercial food cabinets with a 150 gram charge size. The highest expected levels of exposure for this end-use occur in the lower stratum of the room. The result for propane is a 15-minute TWA of 10,414 ppm and a 30-minute TWA of 7,963 ppm. The 10-minute (AEGL)-1 value for propane is 10,000 ppm.⁹ Specifically, for propane at the end-use, the modeled 15-minute time-weighted average exposure is 10,414 ppm (for practical purposes, there is no difference toxicologically speaking between this value and 10,000 ppm (the AEGL-1 value), especially as this is a modeled concentration and is based on a worst-case scenario). As this exposure concentration is marginally higher than the AEGL-1 and significantly lower than the AEGL-2, serious or permanent toxicological effects are not expected for room occupants at the end-use. Therefore, it is believed that even under the

very conservative assumptions used in this model, exposures to propane should not pose a toxicity threat. As the AEGL is an emergency guideline, and flammability is a concern for this chemical, it is recommended that room occupants should evacuate the space immediately following the accidental release of this refrigerant. As our submitters have stated an accidental release would be caused during service and maintenance therefore the service technicians would know to evacuate. For further information regarding accidental releases or fault tree analyses see the docket number EPA-HQ-OAR-2009-0286.

V. Why is EPA proposing these specific use conditions?

EPA is proposing to find isobutane, HCR-188C, and HCR-188C1 acceptable with use conditions in new household refrigerators and freezers and combination refrigerator and freezers (with a charge of 57 grams (2.0 ounces) or less) and propane acceptable with use conditions in stand-alone retail food refrigerators and freezers (with a charge of 150 grams (5.3 ounces) or less) that are designed and manufactured specifically to use these alternatives. The proposed listings with the specific use conditions are intended to allow for the use of isobutane, propane, HCR-188C, and HCR-188C1 where the current evidence shows that they can be used safely within specified parameters. We also seek comment on the proposed listing as well as the specific use conditions discussed below.

A. New equipment only; not intended for use as a retrofit alternative

EPA is proposing that the four refrigerants considered in this proposal must be used only in new equipment that has been designed and manufactured specifically for use with the listed alternative refrigerant, as follows:

⁹ <http://www.epa.gov/opptintr/ae-gl/pubs/results96.htm> EPA website accessed August 17, 2009

- Isobutane - household refrigerators, freezers, and combination refrigerator and freezers
- Propane – retail food refrigeration (stand-alone only)
- HCR-188C – household refrigerators and freezers and combination refrigerator and freezers
- HCR-188C1 – household refrigerators and freezers and combination refrigerator and freezers

The four refrigerants were not submitted under the SNAP program to be used in retrofitted equipment. Existing equipment designed for other refrigerants may not be converted or retrofitted to use any of these four hydrocarbon refrigerants. These substitutes may be used only in new equipment that is designed to address concerns unique to flammable refrigerants.

B. Standards

EPA is proposing the refrigerants may be used only in equipment that meets all requirements in UL Standard 250 10th edition (for isobutane, HCR-188C, and HCR-188C1 in household refrigerators and freezers) or UL 471 9th edition (for propane in retail food equipment specifically in stand-alone refrigeration and freezers).¹⁰ UL has tested equipment for flammability risk in both household and retail food refrigeration. Further, UL has developed acceptable safety standards including requirements for construction, for markings, and for

¹⁰ EPA is referencing the UL Standard 250 Supplement SA; “Requirements for Refrigerators and Freezers Employing a Flammable Refrigerant in the Refrigerating System”, UL 250 10th edition (for isobutane, HCR-188C, and HCR-188C1 in home refrigerators and freezers) and UL 471 9th edition Supplement SB; “Requirements for Refrigerators and Freezers Employing a Flammable Refrigerant in the Refrigerating System” (for propane in commercial refrigerators and freezers).

performance tests concerning refrigerant leakage, ignition of switching components, surface temperature of parts, and component strength after being scratched.

C. Charge size

EPA is proposing a limitation on charge size for refrigerators and freezers that reflects the UL 250 and UL 471 standards. EPA is proposing a charge size not to exceed 57grams (2.0 ounces) for household refrigerators and freezers and 150 grams (5.3 ounces) for retail food refrigeration in stand-alone units. To place this in comparison, EPA estimates the charge size of a disposable lighter is equal to 30 grams (1.1 ounce).¹¹ Therefore we estimate that charge size of household refrigerators and freezers are equivalent to approximately two disposable lighters while retail stand-alone refrigerators and freezers are equivalent to approximately five disposable lighters or less. In comparison, the household refrigerator and freezer and retail food refrigerator charge size is significantly less than refillable butane lighter fluid which contains 340 grams (12 ounces). The refrigerant charge is smaller than the disposable propane fuel cylinders used for camping which contains 468 grams (16.4 ounces).

The UL 250 standard limits the amount of refrigerant that may leak to 50 grams (1.8 ounces). EPA selected 57 grams (2.0 ounces) to allow for up to 7 grams (0.2 ounces) of refrigerant charge that might be solubilized in the oil (and assumed not to not leak or immediately vaporize with the refrigerant in the case of a leak). UL standard 471 limits the amount leaked to 150 grams (5.3 ounces). Furthermore, the charge size limit for propane (for retail food refrigeration) is in line with the IEC 60335-2-89 standard for commercial appliances, which has a charge size limit of 150 grams (5.3 ounces). EPA did not include an additional 7grams (0.2 ounces) of refrigerant that would be solubilized in the oil as we did in the household refrigerator and freezers end use. This is because 157 grams (5.5 ounces) would be over the international charge size standard for

retail food refrigeration. As the international household refrigerator and freezers standard's charge size limit is 150 grams (5.3 ounces) larger than UL 250 standard, EPA's suggested charge size for household refrigerator and freezers would be well below the international charge size limit. EPA is taking comment on the charge size limit on both the household refrigerator and freezers and retail food refrigeration end use.

D. Color-coded hoses and piping

EPA proposes that equipment must have distinguishing color-coded hoses and piping to indicate use of a flammable refrigerant. This will help technicians immediately identify the use of a flammable refrigerant, thereby potentially reducing the risk of using sparking equipment or otherwise having an ignition source nearby. The air conditioning and refrigeration industry currently uses distinguishing colors as means for identifying different refrigerants. Likewise, distinguishing coloring has been used elsewhere to indicate an unusual and potentially dangerous situation, for example in the use of orange-insulated wires in hybrid electric vehicles. EPA is proposing that all such refrigerator tubing be colored red Pantone Matching System (PMS) #185 to match the red band displayed on the container of flammable refrigerants under the Air Conditioning, Heating and Refrigeration Institute (AHRI) Guideline "N" 2008, "2008 Guideline for Assignment of Refrigerant Container Colors." EPA believes that one color is sufficient for both household refrigerator and freezers and retail food refrigeration (stand-alone units) to indicate the equipment contains a flammable refrigerant.

EPA wants to ensure that there is no doubt that a flammable refrigerant is being used within the equipment or appliance. Currently, no industry standard exists for color-coded hoses or pipes

¹¹ Study conducted by Ben and Jerry's/Unilever on the weight of butane contained in disposable lighters

for isobutane, propane, HCR-188C, or HCR-188C1. EPA is taking comment on the potential development of an industry-wide standard for hoses and pipes for flammable refrigerants.

One mechanism to distinguish hoses and pipes that EPA would find acceptable is to add a colored plastic sleeve or cap to the service tube. The colored plastic sleeve or cap would have to be forcibly removed in order to access the service tube. This would signal to the technician that the refrigeration circuit that she/he was about to access contained a flammable refrigerant, even if all warning labels were somehow removed. This sleeve could be boldly marked with a specific color or graphic to indicate the refrigerant was flammable. This could be a cost-effective means as an alternative to painting or dyeing the hose or pipe. EPA is taking comment on this mechanism of distinguishing the pipe and hose by adding a colored plastic sleeve or cap to the pipe or hose.

EPA is particularly concerned with ensuring adequate and proper notification for servicing and disposal of appliances containing flammable refrigerants. EPA believes the use of color-coded hoses, as well as the use of warning labels and unique fittings discussed below, would be reasonable and would be consistent with other general industry practices. EPA requests comment on whether such color coding would provide, in combination with other proposed use conditions, adequate warning of the use of a flammable refrigerant and, if so, whether such color-coding should be required for all tubing or just some, e.g., around service ports.

E. Labeling

As a use condition, EPA is proposing to require labeling of household and retail refrigerators and freezers. EPA is proposing the warning labels on the equipment contain letters at least ¼

inch high. The label must be permanently affixed to the refrigerator until the refrigerator's end of life. Warning label language for household refrigerators and freezers is found in UL 250 as SA6.1 and for commercial refrigerators and freezers in UL 471 as SB6.1.

EPA believes that it would be difficult to see the warning labels with UL 250 and 471's minimum lettering height requirement of 1/8 inch. Therefore, EPA is proposing the minimum height must be 1/4 inch as opposed to 1/8 inch for lettering, which will make it easier for technicians, consumers, retail storeowners, and emergency first responders to view the warning labels. EPA is requesting comment on requiring labeling, the height of the lettering, whether specific colors or symbols are also needed, and the likelihood of labels remaining on a product throughout the lifecycle of the product, including its disposal.

F. Unique fittings

EPA is proposing that household and retail refrigerators and freezers using these refrigerants must have fittings unique to flammable refrigerants (with unique color and unique thread direction or fitting diameter to the refrigerant). Instead of having separate fittings for each type of flammable refrigerant, EPA believes one unique fitting for all flammable refrigerants is sufficient. We believe that using flammable refrigerants with a unique set of fittings will prevent the accidental mixing of flammable and non-flammable refrigerants. These fittings (male or female, as appropriate) are attachment points on the equipment itself, on all recovery equipment, on charging equipment, and on all refrigerant containers. Unique fittings are defined in 64 FR 22983, April 28, 1999 as: "For screw-on-fittings, "differ" means that either the diameter must differ by at least 1/16 inch or the thread direction must be reversed (i.e., right handed vs. left handed). Simply changing the thread pitch is not sufficient. For quick-connect fittings, "differ"

means that a person using normal force and normal tools (including wrenches) must not be able to cross-connect fittings.”

EPA believes that service ports are necessary to facilitate recovery of refrigerant during service or disposal of appliances. EPA notes that service apertures on small appliances using class I and class II substances is required by the CAA section 608 (b)(2). Service ports allow for the proper recovery of refrigerant during service or disposal of refrigerators and freezers because service ports act as an access point for recovery equipment. As required by 40 CFR 82.154 (a)(1), no refrigerant may be knowingly vented. Therefore, prior to disposal of the equipment all refrigerants must be recovered. Without the service port on the equipment, there is no mechanism to recover the refrigerant without cutting into the refrigerant lines.

In addition, EPA is requiring that flammable refrigerant fittings must be designed to mechanically prevent cross-charging with another non-flammable refrigerant. EPA believes that it is likely that technicians servicing hydrocarbon appliances will also service appliances containing CFC, HCFC, and HFC refrigerants. The multitude of refrigerants could lead to unintentional mixing of recovered refrigerant resulting in emissions of contaminated refrigerant that might not be able to be economically separated and/or reclaimed. EPA believes that unique fittings will aid in the prevention of such contamination that might prevent recycling and reclamation of otherwise useful non-flammable refrigerant. This is especially important as the HCFC allocation rule becomes effective on January 1, 2010, it is expected the supply of HCFC-22 will become limited during the middle of the coming decade. Recycling and reclamation of HCFC-22 will be necessary to maintain an ample supply of HCFC-22.

Traditionally the refrigeration industry has not used unique fittings; however, it has been required in the motor vehicle air conditioning industry since June 13, 1995 (60 FR 31096). For

further clarification please refer to April 28, 1999 (64 FR 22983) where EPA defined uniqueness of fittings for motor vehicle air conditioners using substitutes under SNAP. EPA believes that the use of unique fittings in stationary refrigeration and air conditioning are appropriate for flammable refrigerants. Unique fittings would help maintain the separation of flammable refrigerants from equipment designed for non-flammable refrigerants because the equipment for charging flammable refrigerants would not be able to be used on other equipment. This should reduce the risk of fire by ensuring that flammable refrigerants are used only in equipment designed for flammable refrigerants. In addition, the use of unique fittings can help in identifying the refrigerant being used and reducing the likelihood that flammable refrigerant might contaminate supplies of recovered nonflammable refrigerant containing CFCs, HCFCs, or HFCs.

EPA requests comments on the potential use of unique fittings, whether one such unique fitting is adequate to cover all flammable refrigerants, the adequacy of the definition of unique fittings, and the likelihood that such fitting would achieve the objectives of avoiding refrigerant contamination and maintaining safety in a market where both flammable and non-flammable refrigerants may be utilized. EPA is also requesting comment on the applicability of the ANSI/ASHRAE 34-2007 standard for flammability and whether these use conditions are appropriate to ensure safety.

G. Small containers

EPA is proposing that these four refrigerants may not be sold for use in the listed end uses as a refrigerant in containers in quantities of less than five pounds (2.8 kg). This restriction would ban the sale of small canisters of refrigerant-grade hydrocarbons. The purpose of this proposal is

to prevent purchase by untrained people who would not have the appropriate skills or equipment to properly recover or charge the refrigerant. Larger containers of flammable refrigerant would also typically be purchased by technicians rather than untrained people because the larger amount of refrigerant would be less useful to individual users, who would typically need only a small amount, and the larger quantity could be cost prohibitive to individual users. Therefore this would reduce the possibility that untrained people would handle the flammable refrigerant, accidentally add flammable refrigerants to a CFC, HCFC, or HFC refrigerant, or would incorrectly dispose of the containers.

Contaminating a CFC, HCFC, or HFC refrigerant will cause the refrigerant to be potentially unusable. Mixing of refrigerants is counter to overall Title VI implementation. Consequently, the wasted refrigerant would have to be disposed of properly rather than reused, potentially further limiting the tight supply of HCFC-22 in the coming decade. The SNAP program, together with other Title VI regulations, seeks to ensure a smooth transition as we continue to phase out ODS, including HCFC-22. In addition to contaminating the refrigerant, an untrained person could potentially add a flammable refrigerant to equipment that is not designed for flammable refrigerant and, as a result, damage the equipment or appliance or create a fire hazard. To prevent refrigerant contamination, addition of the incorrect refrigerant, or incorrect disposal of canisters and to avoid the risk of explosions or fire, EPA proposes a use condition prohibiting small containers of isobutane, propane, HCR-188C, and HCR-188C1, i.e., containers of less than five lbs (2.8 kg). EPA is seeking comment on this restriction on small canisters of refrigerant grade hydrocarbons such as R-600a, R-290, HCR-188C, and HCR-188C1. EPA is also requesting comment on the potential cost of the containers of hydrocarbon refrigerant and if the

cost of such containers of hydrocarbon refrigerants would be different from the current cost of a similar quantity of propane or isobutane currently sold for other purposes.

VI. What recommendations does EPA have for safe use of hydrocarbon refrigerants?

EPA proposes to recommend that only technicians specifically trained in handling flammable refrigerants service or dispose of refrigerators and freezers containing these refrigerants. Technicians must know how to minimize the risk of fire and the procedures for using flammable refrigerants safely. Releases of large quantities of refrigerant during servicing and manufacturing, especially in areas where large amounts of refrigerant are stored, could cause an explosion if an ignition source exists nearby. For these reasons, it is important that only properly trained technicians handle flammable refrigerants when servicing or disposing of household and retail food refrigerators and freezers.

EPA is unaware of any existing industry-wide technician training program or standard that fully covers the safe use of flammable refrigerants. EPA has reviewed several training programs provided as part of SNAP submissions from persons interested in flammable refrigerants. EPA intends to update the CAA section 608 technician certification test bank provided to organizations that administer the certification exams in accordance with 40 CFR 82.161 to specifically address flammable refrigerants. EPA requests any information on an industry-wide flammable refrigerant training program, whether such a program is under development, the burden on the technicians to take an industry wide safety training, and the timeline likely needed to develop such a program in order to begin training a nation-wide fleet of technicians.

VII. What other options did EPA consider?

EPA considered several different options in preparing this proposed rule. Although EPA is not proposing these options, which are discussed below, we seek comment on them.

EPA considered allowing isobutane and propane as a refrigerant for use only in the original equipment manufacturers' (OEM) specific appliances, described in a SNAP application. The reason for such a limitation is the concern that equipment from other manufacturers would not be designed with spark-proof engineering as prescribed by the submitter, nor would the manufacturers be able to develop recovery equipment compatible with flammable refrigerants.

Limiting use to SNAP reviewed equipment would be time consuming and costly for all parties involved. EPA would have to consider each refrigerator and freezer model for both household and retail separately. This would increase the burden on industry, with little added benefit for health and safety, since the engineering of such equipment and the requirements needed to meet a national safety standard are already rigorous. Although there is the potential that some OEMs might not develop proper equipment, EPA believes that the potential liability associated with selling equipment not designed to safely use these refrigerants should ensure that this does not occur. Therefore, EPA decided to not propose to limit use to equipment reviewed by EPA through the SNAP program.

EPA also considered a specific use condition requiring "spark proof" circuits in the design of equipment using hydrocarbon refrigerants. EPA believes it would be unnecessary to further require "spark proof circuits" as a use condition because UL 250 and UL 471 already require strict standards, to prevent fire or explosion, which must be met in order to obtain certification. We believe that all OEMs will also take into account flammability risks when designing the appliance to meet the charge size requirement.

EPA also considered proposing as a use condition that recovery equipment used to recapture these refrigerants must be able to handle flammable refrigerants. In accordance with CAA Section 608 regulations, refrigerant cannot be vented to the atmosphere and instead must be recaptured and recycled, reclaimed if possible, or disposed of in accordance with federal and state regulations. For safety concerns, recovery equipment appropriate for flammable refrigerants will be needed. EPA seeks data on whether there currently is an industry standard for recovery units for flammable refrigerants and whether there are available specific recovery units that are compatible with isobutane, propane, HCR-188C, and HCR-188C1. At this time, EPA is unaware of any recovery units that are designed specifically for hydrocarbons and which are readily available in the U.S. EPA did not propose that recovery equipment used to recapture hydrocarbon refrigerants because this is better addressed under Section 608.

Under Section 608 of the CAA, venting of hydrocarbons for household refrigerators and freezers and retail food refrigeration (stand-alone refrigerators and freezers) could be allowed if EPA determines that such venting, releasing, or disposing of such substance does not pose a threat to the environment. EPA is not proposing such a determination in this rule making, but requests comment on whether hydrocarbon refrigerants should be exempted from the Section 608 venting prohibition. As appropriate, EPA would address these issues in a separate

EPA also considered other approaches such as:

- Requiring only one use condition for each refrigerant; to meet the UL 250 or 471 standards;
- Finding hydrocarbon refrigerants unacceptable until an industry-wide standard exists for servicing refrigerator using hydrocarbon refrigerant;

EPA is taking comment on the above alternate approaches.

VIII. Statutory and Executive Order Reviews

A. Executive Order 12866: Regulatory Planning and Review

Under Executive Order (EO) 12866 (58 FR 51735, October 4, 1993), this action is a "significant regulatory action." It raises novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order. Accordingly, EPA submitted this action to the Office of Management and Budget (OMB) for review under EO 12866 and any changes made in response to OMB recommendations have been documented in the docket for this action.

B. Paperwork Reduction Act

This action does not impose any new information collection burden. This proposed rule is an Agency determination. It contains no new requirements for reporting. The only new recordkeeping requirement involves customary business practice. The Office of Management and Budget (OMB) has previously approved the information collection requirements contained in the existing regulations in subpart G of 40 CFR part 82 under the provisions of the Paperwork Reduction Act, 44 U.S.C. 3501 et seq. and has assigned OMB control numbers 2060-0226 (EPA ICR No. 1596.05). This Information Collection Request (ICR) included five types of respondent reporting and recordkeeping activities pursuant to SNAP regulations: submission of a SNAP petition, filing a SNAP/TSCA Addendum, notification for test marketing activity, recordkeeping for substitutes acceptable subject to use restrictions, and recordkeeping for small volume uses.

The OMB control numbers for EPA's regulations are listed in 40 CFR part 9 and 48 CFR Chapter 15.C.

C. Regulatory Flexibility Act (RFA)

The RFA generally requires an agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions. For purposes of assessing the impacts of this rule on small entities, small entity is defined as: (1) A small business as defined by the Small Business Administration's (SBA) regulations at 13 CFR 121.201; (2) a small governmental jurisdiction that is a government of a city, county, town, school district or special district with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.

After considering the economic impacts of this proposed rule on small entities, I certify that this action will not have a significant economic impact on a substantial number of small entities. The requirements of this proposed rule impact household and commercial refrigerator and freezer manufacturers. This rule indirectly affects users, technician testing organizations, and technicians. Today's action, if finalized, would allow users the additional options of using isobutane, propane, HCR-188C, and HCR-188C1. Because isobutane, propane, HCR-188C and HCR-188C1 refrigeration systems are not manufactured yet, no change in business practice would be required to meet the use conditions and thus the rule would not impose any new costs

on small entities if finalized as proposed. EPA continues to be interested in the potential impacts of the proposed rule on small entities and welcome comments on issues related to such impacts.

D. Unfunded Mandates Reform Act

This action contains no Federal mandates under the provisions of Title II of the Unfunded Mandate Reform Act of 1995 (UMRA), 2 U.S.C. 1531-1538 for State, local, or tribal governments or the private sector. This action imposes no enforceable duty on any State, local, or tribal governments or the private sector.

The enforceable requirements of this proposed rule related to integrating risk mitigation devices, markings, and procedures for maintaining safety of household refrigerators, freezers, and combination refrigerator and freezers systems using hydrocarbon refrigerants affect only small number of manufacturers of household and commercial refrigerators, freezers, and combination refrigerator and freezers and their technicians. This proposal provides additional refrigerant options, allowing greater flexibility for industry in designing consumer products. Further, equipment using hydrocarbon refrigerants is not yet being produced in the U.S. therefore we do not expect impacts on existing users. Thus, this rule is not subject to the requirements of sections 202 and 205 of the UMRA. This action is also not subject to the requirements of section 203 of UMRA because it contains no regulatory requirements that might significantly or uniquely affect small governments. This regulation applies directly to facilities that use these substances and not to governmental entities. The acceptability with use conditions of isobutane, propane, HCR-188C, and HCR-188C1 does not impact the private sector because manufacturers are not producing systems under the current regulation. This proposed rule does not mandate a

switch to these substitutes; consequently, there is no direct economic impact on entities from this rulemaking.

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, as specified in Executive Order 13132. This regulation applies directly to facilities that use these substances and not to governmental entities. Thus, Executive Order 13132 does not apply to this action. In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between EPA and State and local governments, EPA specifically solicits comments on this proposed action from State and local officials.

F. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

This action does not have tribal implications, as specified in Executive Order 13175 (65 FR 67249, November 9, 2000). 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. EPA specifically solicits additional comment on this proposed action from tribal officials.

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

This action is not subject to Executive Order 13045 (62 FR 19885, April 23, 1997) because it is not economically significant as defined in EO 12866, and because the Agency does not believe the environmental health or safety risks addressed by this action present a disproportionate risk to children. This proposed rule provides both regulatory restrictions and recommended guidelines based upon risk screens conducted in order to reduce risk of fire and explosion. The public is invite to submit comments or identify peer-reviewed studies and data that assess effects, of early life exposure to the refrigerant addressed in this action.

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

This action is not a “significant energy action” as defined in Executive Order 13211, (66 FR 28355 (May 22, 2001)) because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. Preliminary information indicates that these new systems may be more energy efficient than currently available systems in some climates. Further, we have concluded that this rule is not likely to have any adverse energy effects.

I. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 ("NTTAA"), Pub L. No. 104-113, (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or

otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. The NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This proposed rule involves technical standards. EPA proposes to use the Underwriters Laboratory (UL) standard 250 and 471, which was revised to include requirements for safety and reliability for flammable refrigerants. This proposed rule regulates the safety and deployment of new substitutes for household and commercial refrigerators and freezers.

EPA welcomes comment on this aspect of the proposed rulemaking and, specifically invites the public to identify potentially applicable voluntary consensus standards and to explain why such standards should be used in this regulation.

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

Executive Order (EO) 12898 (59 FR 7629 (Feb. 16, 1994)) establishes federal executive policy on environmental justice. Its main provision 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 and low-income populations in the United States.

EPA has determined that this proposed rule will not have disproportionately high and adverse human health or environmental effects on minority or low-income populations because it increases the level of environmental protection for all affected populations without having any disproportionately high and adverse human health or environmental effects on any population, including any minority or low-income population. This proposed rule would provide refrigerant substitutes that have no ODP and low GWP. The reduction in ODS and GWP emissions would assist in restoring the stratospheric ozone layer and provide climate benefits.

IX. References

The documents below are referenced in the preamble. All documents are located in the Air Docket at the address listed in Section I.B.1 at the beginning of this document. Unless specified otherwise, all documents are available electronically through the Federal Docket Management System, Docket # EPA-HQ-OAR-2009-0286. Numbers listed after the reference indicates the docket and item numbers.

ACGIH. 1991. Propane. In: Documentation of the threshold limit values and biological exposure indices. 6th ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists, pp. 1286-1287.

ASHRAE. 2007. "Standard 34-2007 (Supersedes ANSI/ASHRAE Standard 34-2004) Designation and Safety Classification of Refrigerants."

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EPA 1994. Significant New Alternatives Policy Technical Background Document: Risk Screen

on the Use of Substitutes for Class I Ozone-Depleting Substances: Refrigeration and Air Conditioning. Stratospheric Protection Division. March, 1994.

ICF, 2009. ICF Consulting. "Significant New Alternatives Policy Program Refrigeration and Air Conditioning Sector – Risk Screen on Substitutes for CFC-12 in Household Refrigerators and Household Freezers – Substitute: Isobutane", May 22, 2009.

ICF, 2009. ICF Consulting. "Significant New Alternatives Policy Program Refrigeration and Air Conditioning Sector – Risk Screen on Substitutes for CFC-12, HCFC-22 and R502 in Retail Food Refrigeration – Substitute: Propane", May 26, 2009.

ICF, 2009. ICF Consulting. "Significant New Alternatives Policy Program in the Household Refrigeration Sector – Risk Screen on Substitutes for CFC-12 and HCFC-22 in Household Refrigerators, Household Freezers and Window AC Units – Substitute: HCR-188C", July 17, 2009.

ICF, 2009. ICF Consulting. "Significant New Alternatives Policy Program in the Household Refrigeration Sector – Risk Screen on Substitutes for CFC-12 and HCFC-22 in Household Refrigerators and Freezers– Substitute: HCR-188C1", November 6, 2009

NIOSH. 1996. Propane: IDLH Documentation. August 1996. Accessed 17 February 2009. Available online at: < <http://www.cdc.gov/niosh/idlh/74986.html>>.

OSHA. 2004. "Safety and Health Topics: Isobutane." February 2004. Available online at: <http://www.osha.gov/dts/chemicalsampling/data/CH_247840.html>.

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**Protection of Stratospheric Ozone: Listing of Substitutes for Ozone-Depleting
Substances– Hydrocarbon refrigerants**

Notice of Proposed Rulemaking

List of Subjects in 40 CFR Part 82

Environmental protection, Administrative practice and procedure, Air pollution control,
reporting and recordkeeping requirements

Page 53 of 60 pages

Dated: 4/29/10



Lisa P. Jackson,
Administrator.

For the reasons set out in the preamble, 40 CFR part 82 is proposed to be amended as follows:

PART 82 - PROTECTION OF STRATOSPHERIC OZONE

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

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

Subpart G – Significant New Alternatives Policy Program

2. Subpart G is amended by adding Appendix R to read as follows:

Appendix R to Subpart G - Substitutes Subject to Use Restrictions and Unacceptable Substitutes
Listed in the [**publication date of final rule**] final rule. Effective (date of effective date of the
final rule)

SUBSTITUTES THAT ARE ACCEPTABLE SUBJECT TO USE CONDITIONS

	Substitute	Decision	Use Conditions	Further Information
Household refrigerators and freezers and combination refrigerators and freezers New Only	Isobutane, R-600a, as a substitute for CFC-12 and HCFC-22 HCR-188C as a substitute for CFC-12 and HCFC-22 HCR-188C1 as a substitute for CFC-12 and HCFC-22	Acceptable With Use Conditions	<ol style="list-style-type: none"> 1. The quantity of the substitute refrigerant (i.e., “charge size”) shall not exceed 57 grams (2.0 ounces) in any refrigerator, freezer, or combination refrigerator and freezers; 2. 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); 3. These refrigerants may be used only in refrigerators or freezers or combination refrigerator and freezers that meet all requirements listed in the 10th edition of Underwriters Laboratory (UL) Standard 250. In cases where the final rule includes requirements more stringent than those of the 10th edition of UL Standard 250, the appliance must meet the requirements of the final rule in place of the requirements in the UL Standard; 4. The refrigerator, freezer, or combination refrigerator and freezer 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 where service puncturing or otherwise 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>Technicians and equipment manufactures should wear appropriate personal protective equipment, including chemical goggles and protective gloves when handling isobutane, HCR-188C, and HCR-188C1. Special care should be taken to avoid contact with the skin since isobutane, HCR-188C, and HCR-188C1 like many refrigerants, can cause freeze burns on the skin.</p> <ul style="list-style-type: none"> •A class B dry powder type fire extinguisher should be kept nearby. •Proper ventilation should be maintained at all times during the manufacture of equipment containing hydrocarbon refrigerant through adherence to good manufacturing practices as per 29 CFR 1910.110.¹² If refrigerant levels in the air surrounding the equipment rise above one-fourth of the lower flammability limit,¹ the space should be evacuated and re-entry should only occur after the space has been properly ventilated. • Technicians should only use spark proof tools when working refrigerators and freezers with R-600a, HCR-188C, and HCR-188C1. • Recovery equipment designed for flammable refrigerants should be used. • 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. •In production facilities or other facilities where large quantities of the refrigerant would be stored, proper safety precautions should be in place to minimize the risk of explosion. These facilities should be equipped with proper ventilation systems to minimize the risks of explosion and should be properly designed and operated to reduce possible ignition sources.

¹² OSHA regulation 29 CFR 1910.110 considers ventilation adequate “when the concentration of the gas in a gas-air mixture does not exceed 25 percent of the lower flammable limit.”

End Use	Substitute	Decision	Use Conditions	Further Information
<p>Household refrigerators and freezers and combination refrigerators and freezers</p> <p>New Only</p>	<p>Isobutane, R-600a, as a substitute for CFC-12 and HCFC-22</p> <p>HCR-188C as a substitute for CFC-12 and HCFC-22</p> <p>HCR-188C1 as a substitute for CFC-12 and HCFC-22</p>	<p>Acceptable With Use Conditions</p>	<p>5. Similar to clauses SA6.1.1 to SA6.1.2 of UL standard 250, the following markings, or the equivalent, shall be provided and shall be permanent:</p> <ul style="list-style-type: none"> a) "DANGER- Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing." b) "DANGER- Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing." 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." d) "CAUTION - Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used." e) "CAUTION - Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used." <p>The marking described in clause (a) above shall be provided on or near any evaporators that can be contacted by the consumer. The markings described in clauses (b) and (c) above shall be permanently attached near the machine compartment. The markings described in clause (d) above shall be permanently attached on the exterior of the refrigerator. The marking described in clause (e) above shall be permanently attached near any and all exposed refrigerant tubing. All of these markings shall be in letters no less than 6.4 mm (1/4 inch) high.</p>	<p>•Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p>

End Use	Substitute	Decision	Use Conditions	Further Information
<p>Household refrigerators and freezers and combination refrigerators and freezers</p> <p>New Only</p>	<p>Isobutane, R-600a, as a substitute for CFC-12 and HCFC-22</p> <p>HCR-188C as a substitute for CFC-12 and HCFC-22</p> <p>HCR-188C1 as a substitute for CFC-12 and HCFC-22</p>	<p>Acceptable With Use Conditions</p>	<p>6. Household refrigerators, freezers, and combination refrigerator and freezers using these refrigerants must have service aperture fittings that are colored red as described above in use condition number four and which differ from fittings used in equipment or containers using non-flammable refrigerant. "Differ" means that either that the diameter must differ by at least 1/16 inch or the thread direction must be reversed (i.e., right handed vs. left handed). The unique fittings must be permanently affixed to the unit and may not be accessed with an adaptor until the end-of-life of the unit;</p> <p>7. These refrigerants may not be sold for use as a refrigerant in containers designed to contain less than five pounds (2.8 kg) of refrigerant.</p>	

End Use	Substitute	Decision	Use Conditions	Further Information
Retail Food Refrigeration (stand-alone only) New Only	Propane, R-290, as a substitute for CFC-12 and HCFC-22	Acceptable subject to use conditions	<ol style="list-style-type: none"> 1. The charge size for the retail food refrigerator or freezer using R-290 shall not exceed 150 grams (5.3 ounces); 2. This refrigerant may be used only in new equipment specifically designed and clearly identified for the refrigerant; 3. This substitute may only be used in equipment that meets all requirements in the 9th edition of UL Standard 471. In cases where the final rule includes requirements more stringent than those of the 9th edition of UL Standard 471, the appliance must meet the requirements of the final rule in place of the requirements in the UL Standard; 4. The refrigerator or freezer must have red, Pantone Matching System (PMS) #185 marked pipes, hoses, and 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 where service puncturing or otherwise 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>Technicians and equipment manufactures should wear appropriate personal protective equipment, including chemical goggles and protective gloves when handling isobutane. Special care should be taken to avoid contact with the skin since propane, like many refrigerants, can cause freeze burns on the skin.</p> <ul style="list-style-type: none"> •A class B dry powder type fire extinguisher should be kept nearby. •Proper ventilation should be maintained at all times during the manufacture of equipment containing hydrocarbon refrigerant through adherence to good manufacturing practices as per 29 CFR 1910.110.¹³ If refrigerant levels in the air surrounding the equipment rise above one-fourth of the lower flammability limit,² the space should be evacuated and re-entry should only occur after the space has been properly ventilated. •Technicians should only use spark proof tools when working refrigerators and freezers with R-290. •Recovery equipment designed for flammable refrigerants should be used. •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. •In production facilities or other facilities where large quantities of the refrigerant would be stored, proper safety precautions should be in place to minimize the risk of explosion. These facilities should be equipped with proper ventilation systems to minimize the risks of explosion and should be properly designed and operated to reduce possible ignition sources.

Note: In accordance with the limitations provided in Section 310(a) of the Clean Air Act (42 U.S.C. 7610(a)), nothing in this table shall affect the Occupational Safety and Health Administrations' authority to promulgate and enforce standards and other requirements under the Occupational Safety and Health Act of 1970 (29 U.S.C. 651 et seq.)

¹³ OSHA regulation 29 CFR 1910.110 considers ventilation adequate "when the concentration of the gas in a gas-air mixture does not exceed 25 percent of the lower flammable limit."

End Use	Substitute	Decision	Use Conditions	Further Information
<p>Retail Food Refrigeration (stand-alone only)</p> <p>New Only</p>	<p>Propane, R-290, as a substitute for CFC-12 and HCFC-22</p>	<p>Acceptable subject to use conditions</p>	<p>5. Similar to clauses SB6.1.2 to SB6.1.5 of UL Standard 471, the following markings, or the equivalent, shall be provided and shall be permanent:</p> <ul style="list-style-type: none"> a) "DANGER- Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing." b) "DANGER- Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing." 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." d) "CAUTION - Risk of Fire or Explosion. Dispose of Property In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used." e) "CAUTION - Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used." This marking shall be provided near all exposed refrigerant tubing. <p>The marking described in clause (a) above shall be permanently attached on or near any evaporators that can be contacted by the consumer. The markings described in clauses (b) and (c) above shall be located near the machine compartment. The marking described in clause (d) above shall be permanently attached on the exterior of the refrigerator. The marking described in clause (e) above shall be permanently attached near any and all exposed refrigerant tubing. All of these markings shall be in letters no less than 6.4 mm (1/4 inch) high.</p>	<ul style="list-style-type: none"> • Room occupants should evacuate the space immediately following the accidental release of this refrigerant.

End Use	Substitute	Decision	Use Conditions	Further Information
<p>Retail Food Refrigeration (stand-alone only)</p> <p>New Only</p>	<p>Propane, R-290, as a substitute for CFC-12 and HCFC-22</p>	<p>Acceptable subject to use conditions</p>	<p>7. Retail food refrigeration using R-290 must have fittings are colored red as described above in use condition number four and which differ from fittings used in equipment or containers using non-flammable refrigerant. "Differ" means that either that the diameter must differ by at least 1/16 inch or the thread direction must be reversed (i.e., right handed vs. left handed). The unique fittings must be permanently affixed to the unit, and may not be accessed with an adaptor, until the end-of-life of the unit;</p> <p>8. R-290 may not be sold as a refrigerant in containers containing less than five pounds (2.8 kg) of refrigerant.</p>	