



ENVIRONMENTAL PROTECTION AGENCY

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40 CFR Part 82

[EPA-HQ-OAR-2003-0118; FRL-9953-72-OAR]

RIN 2060-AG12

Protection of Stratospheric Ozone: Determination 32 for Significant New Alternatives Policy Program

AGENCY: Environmental Protection Agency (EPA).

ACTION: Determination of acceptability.

SUMMARY: This determination of acceptability expands the list of acceptable substitutes pursuant to the U.S. Environmental Protection Agency's (EPA) Significant New Alternatives Policy (SNAP) program. This action lists as acceptable additional substitutes for use in the refrigeration and air conditioning sector and fire suppression and explosion protection sectors.

DATES: This determination is effective on [**Insert date of publication in the Federal Register**].

ADDRESSES: EPA established a docket for this action under Docket ID No. EPA-HQ-OAR-2003-0118 (continuation of Air Docket A-91-42). All electronic documents in the docket are listed in the index at www.regulations.gov. Although listed in the index, some information is not publicly available, i.e., Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Publicly available docket materials are available either electronically at www.regulations.gov or in hard copy at the EPA Air Docket (Nos. A-91-42 and EPA-HQ-OAR-2003-0118), EPA Docket Center (EPA/DC), William J. Clinton West, Room 3334, 1301 Constitution Avenue, NW, Washington, DC 20460. 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 Docket is (202) 566-1742.

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Overnight or courier deliveries should be sent to the office location at 1201 Constitution Avenue, NW, Washington, DC 20004.

For more information on the Agency's process for administering the SNAP program or criteria for the evaluation of substitutes, refer to the initial SNAP rulemaking published in the Federal Register on March 18, 1994 (59 FR 13044). Notices and rulemakings under the SNAP program, as well as other EPA publications on protection of stratospheric ozone, are available at EPA's Ozone Layer Protection website at www.epa.gov/ozone-layer-protection including the SNAP portion at www.epa.gov/snap/.

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Appendix A: Summary of Decisions for New Acceptable Substitutes

I. Listing of New Acceptable Substitutes

This action presents EPA's most recent decision to list as acceptable several substitutes in the refrigeration and air conditioning and fire suppression and explosion protection sectors. New substitutes are:

- R-448A in retail food refrigeration—refrigerated food processing and dispensing equipment;
- R-449A in retail food refrigeration—refrigerated food processing and dispensing equipment;
- R-449B in several refrigeration end-uses; and
- *trans*-1-chloro-3,3,3,-trifluoroprop-1-ene in total flooding fire suppression.

For copies of the full list of acceptable substitutes for ozone depleting substances (ODS) in all industrial sectors, visit the SNAP portion of EPA's Ozone Layer Protection website at www.epa.gov/snap/substitutes-sector. Substitutes listed as unacceptable; acceptable, subject to narrowed use limits; or acceptable, subject to use conditions are also listed in the appendices to 40 CFR part 82, subpart G.

The sections below discuss each substitute listing in detail. Appendix A contains tables summarizing today's listing decisions for these new substitutes. The statements in the “Further Information” column in the tables provide additional information, but are not legally binding under section 612 of the Clean Air Act (CAA). In addition, the “Further Information” column

may not include a comprehensive list of other legal obligations you may need to meet when using the substitute. Although you are not required to follow recommendations in the “Further Information” column of the table to use a substitute consistent with section 612 of the CAA, some of these statements may refer to obligations that are enforceable or binding under federal or state programs other than the SNAP program. In many instances, the information simply refers to standard operating practices in existing industry standards and/or building codes. When using these substitutes, EPA strongly encourages you to apply the information in this column. Many of these recommendations, if adopted, would not require significant changes to existing operating practices.

You can find submissions to EPA for the substitutes listed in this document, as well as other materials supporting the decisions in this action, in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov.

A. Refrigeration and Air Conditioning

1. R-448A

EPA’s decision: EPA finds R-448A acceptable as a substitute for use in:

- Retail food refrigeration—refrigerated food processing and dispensing equipment (new and retrofit equipment)

R-448A, marketed under the trade name Solstice[®] N-40, is a weighted blend of 26 percent HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); 26 percent HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); 21 percent HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); 20 percent HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No.

754-12-1); and 7 percent HFO-1234ze(E), which is also known as *trans*-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Solstice[®] N-40 (R-448A) SNAP Information Notice.” EPA performed assessments to examine the health and environmental risks of this substitute. These assessments are available in Docket EPA-HQ-OAR-2003-0118 under the following name:

- “Risk Screen on Substitutes in Retail Food Refrigeration Substitute: R-448A (Solstice[®] N-40)”

EPA previously listed R-448A as an acceptable refrigerant in a number of other refrigeration and air conditioning end-uses (e.g., July, 16, 2015, 80 FR 42053).

Environmental information: R-448A has an ODP of zero. Its components, HFC-32, HFC-125, HFC-134a, HFO-1234yf, and HFO-1234ze(E) have a 100-year integrated global warming potentials (100-yr GWPs) of 675; 3,500; 1,430; one to four;^{1,2} and one to six;³ respectively. If these values are weighted by mass percentage, then R-448A has a GWP of about 1,390. The components of R-448A are excluded from the definition of volatile organic compound (VOC) under CAA regulations (see 40 CFR 51.100(s)) addressing the development of State Implementation Plans (SIPs) to attain and maintain the National Ambient Air Quality Standards (NAAQS). Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

¹ Hodnebrog *et al.*, 2013. *Op. cit.*

² Nielsen, O. J., Javadi, M. S., Sulbaek Andersen, M. P., Hurley, M. D., Wallington, T. J., Singh, R. Atmospheric chemistry of CF₃CF=CH₂: Kinetics and mechanisms of gas-phase reactions with Cl atoms, OH radicals, and O₃. *Chemical Physics Letters* 439, 18-22, 2007.

³ Hodnebrog *et al.*, 2013 and Javadi *et al.*, 2008. *Op. cit.*

Flammability information: R-448A, as formulated and even considering the worst-case of fractionation for flammability, is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

The American Industrial Hygiene Association (AIHA) has established Workplace Environmental Exposure Levels (WEELs) of 1,000 ppm as an 8-hr time-weighted average (TWA) for HFC-32, HFC-125, and HFC-134a; 500 ppm for HFO-1234yf; and 800 ppm for HFO-1234ze(E), the components of R-448A. The manufacturer of R-448A recommends an acceptable exposure limit (AEL) of 890 ppm on an 8-hour TWA for the blend. EPA anticipates that users will be able to meet the AIHA WEELs and manufacturer's AEL, and address potential health risks by following requirements and recommendations in the manufacturer's safety data sheet (SDS), in the American Society for Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in this end-use: R-448A has an ODP of zero, comparable⁴ to or lower than other listed substitutes in this end-use, with ODPs ranging from zero to 0.098.

⁴ This is in contrast to the historically used ODS CFC-12, R-502A, and HCFC-22 with ODPs ranging from 0.055 to 1.0.

R-448A's GWP of about 1,390 is comparable to or lower than that of HFC-134a with a GWP of 1,430 and a number of HFC blends in this end-use. R-448A's GWP of about 1,390 is higher than those of some other acceptable substitutes in this end-use, including ammonia vapor compression with a secondary loop, CO₂, R-450A, R-513A, and certain blends with GWPs ranging from zero to 920; of these substitutes, ammonia and CO₂ are not listed as acceptable for use in retrofit equipment. We note that R-448A has a GWP toward the higher end of the scale of acceptable alternatives in this end-use. This end-use is a subset of retail food refrigeration and in some instances the equipment in this end use has specialized technical requirements that may limit or prevent use of acceptable substitutes with lower GWPs. In this end-use, we are not aware of significant success in the United States using alternatives with GWPs significantly lower than that for R-448A. However, if it is demonstrated in the future that lower GWP alternatives – either those currently listed or new alternatives added to the list in the future – can be used in this end-use, EPA may evaluate whether those alternatives pose lower overall risk than R-448A and other listed substitutes with similar GWPs.

Flammability and toxicity risks are comparable to or lower than flammability and toxicity risks of other available substitutes in the same end-use. Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15 and other industry standards, recommendations in the SDS, and other safety precautions common in the refrigeration and air conditioning industry.

EPA finds R-448A acceptable in the end-use listed above, because the overall environmental and human health risk posed by R-448A is lower than or comparable to the risks posed by other available substitutes in the same end-use.

2. R-449A

EPA's decision: EPA finds R-449A acceptable as a substitute for use in:

- Retail food refrigeration—refrigerated food processing and dispensing equipment (new and retrofit equipment)

R-449A, marketed under the trade name Opteon[®] XP 40, is a weighted blend of 24.3 percent HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); 24.7 percent HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); 25.7 percent HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and 25.3 percent HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Opteon[®] XP 40 (R-449A) SNAP Information Notice.” EPA performed assessments to examine the health and environmental risks of this substitute. These assessments are available in Docket EPA-HQ-OAR-2003-0118 under the following name:

- “Risk Screen on Substitutes in Retail Food Refrigeration Substitute: R-449A (Opteon[®] XP40)”

EPA previously listed R-449A as an acceptable refrigerant in a number of other refrigeration and air conditioning end-uses (e.g., July, 16, 2015, 80 FR 42053).

Environmental information: R-449A has an ODP of zero. Its components, HFC-32, HFC-125, HFC-134a, and HFO-1234yf have GWPs of 675; 3,500; 1,430; and one to four,⁵ respectively. If these values are weighted by mass percentage, then R-449A has a GWP of about

⁵ Hodnebrog *et al.*, 2013 and Nielsen *et al.*, 2007. *Op. cit.*

1,400. The components of R-449A are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

Flammability information: R-449A, as formulated and even considering the worst-case of fractionation for flammability, is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

The AIHA has established WEELs of 1,000 ppm as an 8-hr TWA for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf, the components of R-449A. The manufacturer of R-449A recommends an AEL of 830 ppm on an 8-hour TWA for the blend. EPA anticipates that users will be able to meet each of the AIHA WEELs and the manufacturer's AEL and address potential health risks by following requirements and recommendations in the SDS, in ASHRAE 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in these end-uses: R-449A has an ODP of zero, comparable⁶ to or lower than the other listed substitutes in this end-use, with ODPs ranging from zero to 0.098.

⁶ This is in contrast to the historically used ODS CFC-12, R-502A, and HCFC-22 with ODPs ranging from 0.055 to 1.0.

R-449A's GWP of about 1,400 is comparable to or lower than that of HFC-134a with a GWP of 1,430 and a number of HFC blends in this end-use. R-449A's GWP of about 1,400 is higher than those of some other acceptable substitutes in this end-use, including ammonia vapor compression with a secondary loop, CO₂, R-450A, R-513A, and certain blends, with GWPs ranging from zero to 920. Ammonia and CO₂ are not listed as acceptable for use in retrofit equipment. We note that R-449A has a GWP toward the higher end of the scale of acceptable alternatives in this end-use. This end-use is a subset of retail food refrigeration with equipment that in some instances has specialized technical requirements that may limit or prevent use of acceptable substitutes with lower GWPs. In this end-use, we are not aware of significant success in the United States using alternatives with GWPs significantly lower than that for R-449A. However, if it is demonstrated in the future that lower GWP alternatives – either those currently listed or new alternatives added to the list in the future – can be used in this end-use, EPA may evaluate whether those alternatives pose lower overall risk than R-449A and other listed substitutes with similar GWPs. Flammability and toxicity risks are comparable to or lower than flammability and toxicity risks of other available substitutes in the same end-use. Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15 and other industry standards, recommendations in the SDS, and other safety precautions common in the refrigeration and air conditioning industry.

EPA finds R-449A acceptable in the end-use listed above, because the overall environmental and human health risk posed by R-449A is lower than or comparable to the risks posed by other available substitutes in the same end-use.

3. R-449B

EPA's decision: EPA finds R-449B acceptable as a substitute for use in:

- Commercial ice machines (new and retrofit equipment)
- Refrigerated transport (new and retrofit equipment)
- Retail food refrigeration—refrigerated food processing and dispensing equipment (new and retrofit equipment)
- Retail food refrigeration-low-temperature stand-alone equipment (i.e., equipment designed to maintain internal temperatures at 32°F (0°C) or below) (new and retrofit)
- Retail food refrigeration--supermarket systems and remote condensing units (new and retrofit)

R-449B, marketed under the trade name Forane[®] 449B, is a weighted blend of 25.2 percent HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); 24.3 percent HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); 27.3 percent HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and 23.2 percent HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).

You may find the redacted submission in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov under the name, “Forane[®] 449B (R-449B) SNAP Information Notice.” EPA performed assessments to examine the health and environmental risks of this substitute. These assessments are available in Docket EPA-HQ-OAR-2003-0118 under the following names:

- Risk Screen on Substitutes in Commercial Ice Machines
Substitute: R-449B (Forane[®] 449B)”

- “Risk Screen on Substitutes in Refrigerated Transport
Substitute: R-449B (Forane[®] 449B)”
- “Risk Screen on Substitutes in Retail Food Refrigeration
Substitute: R-449B (Forane[®] 449B)”
- “Risk Screen on Substitutes in Retail Food Refrigeration—Refrigerated Food Processing and Dispensing Equipment
Substitute: R-449B (Forane[®] 449B)”

Environmental information: R-449B has an ODP of zero. Its components, HFC-32, HFC-125, HFC-134a, and HFO-1234yf have GWPs of 675; 3,500; 1,430; and one to four,⁷ respectively. If these values are weighted by mass percentage, then R-449B has a GWP of about 1,410. The components of R-449B are excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. Knowingly venting or releasing this refrigerant blend is limited by the venting prohibition under section 608(c)(2) of the CAA, codified at 40 CFR 82.154(a)(1).

Flammability information: R-449B, as formulated and even considering the worst-case of fractionation for flammability, is not flammable.

Toxicity and exposure data: Potential health effects of exposure to this substitute include drowsiness or dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. These potential health effects are common to many refrigerants.

⁷ Hodnebrog *et al.*, 2013 and Nielsen *et al.*, 2007. *Op. cit.*

The AIHA has established WEELs of 1,000 ppm as an 8-hr TWA for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf, the components of R-449B. The manufacturer of R-449B recommends an AEL of 865 ppm on an 8-hour TWA for the blend. EPA anticipates that users will be able to meet each of the AIHA WEELs and the manufacturer's AEL and address potential health risks by following requirements and recommendations in the SDS, in ASHRAE 15, and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other substitutes in these end-uses: R-449B has an ODP of zero, comparable⁸ to or lower than the other listed substitutes in these end-uses, with ODPs ranging from zero to 0.098.

For commercial ice machines, many substitutes listed as acceptable have comparable or higher GWPs than R-449B's GWP of about 1,410, such as HFC-134a, R-404A, R-448A, R-449A, and other HFC refrigerant blends, with GWPs ranging from 1,390 to approximately 3,990; other substitutes listed as acceptable substitutes for commercial ice machines have a lower GWP including ammonia absorption, ammonia vapor compression, Stirling cycle, propane,⁹ R-450A, and R-513A with GWPs ranging from zero to about 630.

In refrigerated transport, many substitutes listed as acceptable have comparable or higher GWPs than R-449B's GWP of about 1,410, such as HFC-134a, R-404A, R-448A, R-449A, and other HFC refrigerant blends, with GWPs ranging from 1,390 to approximately 3,990; other substitutes listed as acceptable substitutes for refrigerated transport have a lower GWP including

⁸ This is in contrast to the historically used ODS CFC-12, R-502A, and HCFC-22 with ODPs ranging from 0.055 to 1.0.

⁹ Propane (R-290) is listed as acceptable, subject to use conditions, in this end-use. This substitute is subject to a use condition restricting charge sizes to 150 g or less and thus may limit its use for equipment that requires larger charge sizes.

R-450A, R-513A, CO₂, direct nitrogen expansion, and Stirling cycle, with GWPs ranging from zero to about 630.

R-449B's GWP of about 1,410 is comparable to or lower than that of HFC-134a and a number of HFC and HFC/HFO blends in retail food refrigeration—refrigerated food processing and dispensing equipment. R-449B's GWP of about 1,410 is higher than those of some other acceptable substitutes in new retail food refrigeration—refrigerated food processing and dispensing equipment, including ammonia vapor compression with a secondary loop, CO₂, R-450A, R-513A, and certain blends, with GWPs ranging from zero to 920. Ammonia and CO₂ are not listed as acceptable for use in retrofit equipment. We note that R-449B has a GWP toward the higher end of the scale of acceptable alternatives in this end-use. This end-use is a subset of retail food refrigeration with equipment that in some instances has specialized technical requirements that may limit or prevent use of acceptable substitutes with lower GWPs. In this end-use, we are not aware of significant success in the United States using alternatives with GWPs significantly lower than that for R-449B. However, if it is demonstrated in the future that lower GWP alternatives – either those currently listed or new alternatives added to the list in the future – can be used in this end-use, EPA may evaluate whether those alternatives pose lower overall risk than R-449B and other listed substitutes with similar GWPs.

R-449B's GWP of about 1,410 is comparable to or lower than a number of other substitutes listed as acceptable in retail food refrigeration - supermarket systems and remote condensing units, including HFC-134a, R-407A, R-448A, R-449A, and other HFC refrigerant blends, with GWPs ranging from 1,390 to approximately 2,110. R-449B's GWP of about 1,410 is higher than the GWP of some other acceptable substitutes in retail food refrigeration-

supermarket refrigeration systems and remote condensing units, including CO₂, R-450A, and R-513A with GWPs ranging from zero to about 630.

R-449B's GWP of about 1,410 is comparable to the GWP of substitutes listed as acceptable for retail food refrigeration-low-temperature stand-alone equipment, including the HFO/HFC blends R-448A and R-449A with GWPs of 1,390 and 1,400, HFC-134a with a GWP of 1,430, as well as other HFC blends. R-449B's GWP of about 1,410 is higher than the GWP of some other listed substitutes in this end-use, including CO₂, propane, isobutane, R-441A, R-450A, and R-513A, with GWPs ranging from one to approximately 630.¹⁰ We note that R-449B has a GWP toward the higher end of the scale of acceptable alternatives in the retail food refrigeration—low temperature stand-alone equipment end-use. This end-use is a subset of retail food refrigeration with equipment that in some instances have specialized technical requirements that may limit use of acceptable substitutes with lower GWPs. In this end-use, we are not aware of significant success in the United States using alternatives with GWPs significantly lower than that for R-449B. However, if it is demonstrated in the future that lower GWP alternatives – either those currently listed or new alternatives added to the list in the future – can be used in this end-use, EPA may evaluate whether those alternatives pose lower overall risk than R-449B and other listed substitutes with similar GWPs.

Flammability and toxicity risks are comparable to or lower than flammability and toxicity risks of other available substitutes in the same end-use. Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with the AIHA WEELs, ASHRAE 15

¹⁰ Propane (R-290), isobutane (R-600a), and R-441A are acceptable, subject to use conditions, in this end-use. These three substitutes are subject to a use condition restricting charge sizes to 150 g or less and thus may limit their use for equipment that requires larger charge sizes.

and other industry standards, recommendations in the SDS, and other safety precautions common in the refrigeration and air conditioning industry.

EPA finds R-449B acceptable in the end-uses listed above, because the overall environmental and human health risk posed by R-449B is lower than or comparable to the risks posed by other available substitutes in the same end-uses.

B. Fire Suppression and Explosion Protection

1. *Trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice[®] FS)

EPA's decision: EPA finds trans-1-chloro-3,3,3-trifluoroprop-1-ene acceptable as a substitute for use in:

- Total flooding uses in both normally occupied and unoccupied spaces.

Trans-1-chloro-3,3,3-trifluoroprop-1-ene ((E)-1-chloro-3,3,3-trifluoroprop-1-ene, CAS Reg. No. 102687-65-0) is a chlorofluoroalkene marketed under the trade name Solstice[®] FS for this end-use. Solstice[®] FS is proposed for use in applications including data centers, telecommunication centers, power plants, manufacturing plants, historical buildings, warehouses, and engine nacelles and auxiliary power units (APUs) aboard aircraft.

You may find the redacted submission in Docket item EPA-HQ-OAR-2003-0118-0285 in Docket EPA-HQ-OAR-2003-0118 at www.regulations.gov. EPA has performed an assessment to examine the health and environmental risks of this substitute. This assessment is available in docket EPA-HQ-OAR-2003-0118 under the name, "Risk Screen on Substitutes for Total Flooding Systems in Normally Occupied and Unoccupied Spaces - Substitute: *Trans*-1-Chloro-3,3,3,-trifluoroprop-1-ene (Solstice[®] FS)."

We have previously listed *trans*-1-chloro-3,3,3-trifluoroprop-1-ene as a refrigerant for use in new equipment in centrifugal chillers and non-mechanical heat transfer, as a foam blowing agent, as a cleaning solvent, as an aerosol solvent, and as a carrier solvent in adhesives coatings, and inks (e.g., August 10, 2012, 77 FR 47768; October 21, 2014, 79 FR 62863).

Environmental information: Solstice[®] FS has an ODP of 0.00024 – 0.001512.^{11,12,13} The submitter indicates that Solstice[®] FS has a GWP of 4.7-7 and an atmospheric lifetime of approximately 26 days. Solstice[®] FS is excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)).

Flammability information: Solstice[®] FS is not flammable.

Toxicity and exposure data: Potential health effects of this substitute include serious eye irritation, skin irritation, and frostbite. It may cause central nervous system effects such as drowsiness and dizziness. The substitute could cause asphyxiation if air is displaced by vapors in a confined space. The potential health effects of Solstice[®] FS are unlikely to occur when following good industrial hygiene practices and the personnel protective equipment (PPE) and engineering control (e.g., ventilation) recommendations outlined in the Safety Data Sheet (SDS) for Solstice[®] FS.

To assess potential health risks from exposure to this substitute, EPA considered both occupational and end-user exposure. We evaluated potential risks from chronic occupational

¹¹ The lower bound of the range reflects ODP values for surface emissions. The upper bound of the range takes into account predicted ODP values for higher altitude emissions at various latitudes.

¹² Wang D., Olsen S., Wuebbles D. 2011. "Preliminary Report: Analyses of tCFP's Potential Impact on Atmospheric Ozone." Department of Atmospheric Sciences. University of Illinois, Urbana, IL. September 26, 2011.

¹³ Patten and Wuebbles, 2010. "Atmospheric Lifetimes and Ozone Depletion Potentials of *trans*-1-chloro-3,3,3-trichloropropylene and *trans*-1,2-dichloroethylene in a three-dimensional model." *Atmos. Chem. Phys.*, 10, 10867–10874, 2010.

exposure, such as during manufacture, installation, and servicing. The AIHA has established a WEEL of 800 ppm for *trans*-1-chloro-3,3,3-trifluoroprop-1-ene. The WEEL represents the maximum 8-hour TWA at which a worker can be exposed regularly without adverse effects. The Solstice[®] FS cylinder filling process utilizes quick coupling devices to transfer the substitute from a storage supply to the agent container, which minimizes agent release and keeps potential exposures to levels significantly below the 8-hour WEEL.

During installation or servicing of Solstice[®] FS total flooding systems, if the proper instructions on system installation and servicing included in manuals for the Solstice[®] FS systems and relevant industry standards (i.e., latest edition of the National Fire Protection Association (NFPA) 2001 Standard for Clean Agent Fire Extinguishing Systems and Underwriters' Laboratories (UL) 2166) are adhered to, exposure to the substitute is not likely. In the event of an accidental release of the substitute from the total flooding system, potential acute exposures may be of concern, primarily cardiac sensitization. The manufacturer's maximum design concentration of 6.8 percent covering Class C hazards (energized electrical fires) is significantly below the cardiotoxic NOAEL of 10 percent. Appropriate protective measures should be taken and proper training administered for the manufacture, clean-up and disposal of this product and for the installation and maintenance of the total flooding systems using this product.

NFPA 2001 provides that in the case of accidental release in normally occupied spaces, required engineering controls as specified in NFPA 2001 should be employed to limit personnel exposure to clean agent discharges. Specifically, audible and visual pre-discharge alarms and a

30-60 second time delay should be employed within the protected space to indicate the operation of the system and pending discharge to ensure egress for all personnel prior to activation.

EPA's evaluation indicates that the use of Solstice[®] FS is not expected to pose a significant toxicity risk to personnel or the general population. In addition, the risks it may pose after exposure are common to many total flooding agents, including those already listed as acceptable under SNAP for this same end-use. EPA evaluated the risks associated with potential exposures to Solstice[®] FS during production operations as well as in the case of an inadvertent discharge of the system during maintenance activities on the fire extinguishing system. EPA's review of the human health impacts of Solstice[®] FS, including the summary of available toxicity studies, is in the docket for this action (EPA-HQ-OAR-2003-0118).¹⁴

Protective gloves and tightly sealed goggles should be worn for installation and servicing activities, to protect workers in any event of potential discharge of the proposed substitute, accidental or otherwise. Filling or servicing operations should be performed in well-ventilated areas. Toxicity risks can be minimized by use consistent with NFPA 2001 standard, recommendations in the SDS, and other safety precautions common in the fire suppression industry. In the "Further Information" column of the listing for total flooding agents, EPA is providing the following additional information for establishments manufacturing, installing and maintaining equipment using this agent:

- In the case that Solstice[®] FS is inhaled, person(s) should be immediately removed and exposed to fresh air; if breathing is difficult, person(s) should seek medical attention.

¹⁴ ICF, 2016. Significant New Alternatives Policy Program. Fire Extinguishing and Explosion Prevention Sector. Risk Screen on Substitutes for Total Flooding Systems in Normally Occupied and Unoccupied Spaces - Substitute: *Trans*-1-Chloro-3,3,3-trifluoroprop-1-ene (Solstice[®] FS).

- Eye wash and quick drench facilities should be available. In case of ocular exposure, person(s) should immediately flush the eyes, including under the eyelids, with water for 15 minutes; should frostbite occur, affected areas should be rinsed with lukewarm water, and medical attention should be sought if irritation develops or persists.
- In the case of dermal exposure, the SDS recommends that person(s) should immediately wash the affected area with water and remove all contaminated clothing to avoid irritation; should frostbite occur, bathe (do not rub) the affected area with lukewarm, no hot, water. If water is not available, cover the affected area with a clean soft cloth; and medical attention should be sought if irritation develops or persists.
- Although unlikely, in case of ingestion of Solstice[®] FS, the person(s) should drink a cup of water, if fully conscious, and consult a physician immediately.
- Manufacturing space should be equipped with engineering controls, specifically an adequate exhaust ventilation system, to effectively mitigate potential occupational exposure.
- Employees responsible for chemical processing should wear the appropriate personnel protective equipment (PPE), such as protective gloves, tightly sealed goggles, protective work clothing, and suitable respiratory protection in case of accidental release or insufficient ventilation.
- All spills should be cleaned up immediately in accordance with good industrial hygiene practices.
- Training for safe handling procedures should be provided to all employees that would be likely to handle containers of the agent or extinguishing units filled with the agent.

- This agent should be used in accordance with the safety guidelines in the latest edition of the NFPA 2001 Standard for Clean Agent Fire Extinguishing Systems.
- Safety features that are typical of total flooding systems such as pre-discharge alarms, time delays, and system abort switches should be provided, as directed by applicable OSHA regulations and NFPA standards.

Comparison to other substitutes in these end-uses: Solstice[®] FS has an ODP of 0.00024-0.001512 which is comparable to or lower than the ODP of other acceptable total flooding agents with ODPs that range from zero to 0.048. Solstice[®] FS's GWP of 4.7-7 is significantly lower than that of some of the other alternatives listed as acceptable total flooding agents- such as HFC-227ea, other HFCs, the H-Galden hydrofluoropolyethers, and some HCFC fire suppressants, with GWPs which range from about 1,550 to 14,800. Other acceptable substitutes in this end-use have comparable GWPs ranging from zero to one, such as water, C6-perfluoroketone, and inert gases. Like a number of other acceptable substitutes in this end-use, Solstice[®] FS is excluded from the definition of VOC under CAA regulations (see 40 CFR 51.100(s)).

The toxicity risks due to inhalation exposure are common to many total flooding agents, including those already listed as acceptable under SNAP for this same end-use, such as C6-perfluoroketone. Solstice[®] FS is nonflammable, as are all other available total flooding agents.

EPA finds Solstice[®] FS acceptable in the end-use listed above, because the overall environmental and human health risk posed by Solstice[®] FS is lower than or comparable to the risks posed by other available substitutes in the same end-use.

II. Section 612 Program

A. Statutory Requirements and Authority for the SNAP Program

Section 612 of the CAA requires EPA to develop a program for evaluating alternatives to ozone-depleting substances. 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 substance (CFC, halon, carbon tetrachloride, methyl chloroform, methyl bromide, hydrobromofluorocarbon, and chlorobromomethane) or class II substance (HCFC) 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 www.epa.gov/snap/substitutes-sector and the lists of “unacceptable,” “acceptable subject to use conditions,” and “acceptable subject to narrowed use limits” substitutes are found in the appendices to 40 CFR part 82 subpart G.

3. Petition Process

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

4. 90-day Notification

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

5. Outreach

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

6. Clearinghouse

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

B. EPA's Regulations Implementing Section 612

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

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

C. How the Regulations for the SNAP Program Work

Under the SNAP regulations, anyone who plans to market or produce a substitute to replace a class I substance or class II substance in one of the eight major industrial use sectors must provide the Agency with notice and the required health and safety information on the substitute at least 90 days before introducing it into interstate commerce for significant new use as an alternative (40 CFR 82.176(a)). While this requirement typically applies to chemical manufacturers as the entity likely to be planning to introduce the substitute into interstate commerce,¹⁵ it may also apply to importers, formulators, equipment manufacturers, and end users¹⁶ when they are responsible for introducing a substitute into commerce. The 90-day SNAP review process begins once EPA receives the submission and determines that the submission includes complete and adequate data (40 CFR 82.180(a)). The CAA and the SNAP regulations, 40 CFR 82.174(a), prohibit use of a substitute earlier than 90 days after notice has been provided to the agency.

The Agency has identified four possible decision categories for substitute submissions: acceptable; acceptable subject to use conditions; acceptable subject to narrowed use limits; and

¹⁵ 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.

¹⁶ As defined at 40 CFR 82.172, “end-use” means processes or classes of specific applications within major industrial sectors where a substitute is used to replace an ODS.

unacceptable (40 CFR 82.180(b)).¹⁷ Use conditions and narrowed use limits are both considered “use restrictions” and are explained below. Substitutes that are deemed acceptable without use conditions may be used for all applications within the relevant end-uses within the sector and without limits under SNAP on how they may be used. Substitutes that are acceptable subject to use restrictions may be used only in accordance with those restrictions. Substitutes that are found to be unacceptable may not be used after the date specified in the rulemaking adding such substitute to the list of unacceptable substitutes.¹⁸

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 EPA’s SNAP regulations (40 CFR 82.174(c)).

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 generally requires a user of a substitute subject to narrowed use limits to demonstrate that no other acceptable substitutes are available for their specific application.¹⁹ EPA describes these substitutes as “acceptable subject

¹⁷ The SNAP regulations also include “pending,” referring to submissions for which EPA has not reached a determination, under this provision.

¹⁸ As defined at 40 CFR 82.172, “use” means any use of a substitute for a Class I or Class II ozone-depleting compound, including but not limited to use in a manufacturing process or product, in consumption by the end-user, or in intermediate uses, such as formulation or packaging for other subsequent uses. This definition of use encompasses manufacturing process of products both for domestic use and for export. Substitutes manufactured within the United States exclusively for export are subject to SNAP requirements since the definition of use in the rule includes use in the manufacturing process, which occurs within the United States.

¹⁹ In the case of the July 20, 2015, final rule, EPA established narrowed use limits for certain substitutes over a limited period of time for specific MVAC and foam applications, on the basis that other acceptable

to narrowed use limits.” A person using a substitute that is acceptable subject to narrowed use limits in applications and end-uses that are not consistent with the narrowed use limit is using the substitute in violation of section 612 of the CAA and EPA’s SNAP regulations (40 CFR 82.174(c)).

The section 612 mandate for EPA to prohibit the use of a substitute that may present risk to human health or the environment where a lower risk alternative is available or potentially available²⁰ provides EPA with the authority to change the listing status of a particular substitute if such a change is justified by new information or changed circumstance.

As described in this document and elsewhere, including the initial SNAP rule published in the Federal Register at 59 FR 13044 on March 18, 1994, the SNAP program evaluates substitutes within a comparative risk framework. The SNAP program compares new substitutes both to the ozone-depleting substances being phased out under the *Montreal Protocol on Substances that Deplete the Ozone Layer* and the CAA, and to other available or potentially available alternatives for the same end-uses. The environmental and health risk factors that the SNAP program considers include ozone depletion potential, flammability, toxicity, occupational and consumer health and safety, as well as contributions to global warming and other environmental factors. Environmental and human health exposures can vary significantly depending on the particular application of a substitute – and over time, information applicable to

alternatives would not be available for those specific applications within broader end-uses, but acceptable alternatives were expected to become available over time, e.g., after military qualification testing for foam blowing agents in military applications or after development of improved servicing infrastructure in a destination country for MVAC in vehicles destined for export.

²⁰ In addition to acceptable commercially available substitutes, the SNAP program may consider potentially available substitutes. The SNAP program’s definition of “potentially available “ is “any alternative for which adequate health, safety, and environmental data, as required for the SNAP notification process, exist to make a determination of acceptability, and which the agency reasonably believes to be technically feasible, even if not all testing has yet been completed and the alternative is not yet produced or sold.” (40 CFR 82.172)

a substitute can change. This approach does not imply fundamental tradeoffs with respect to different types of risk, either to the environment or to human health. Over the past twenty years, the menu of substitutes has become much broader and a great deal of new information has been developed on many substitutes. Because the overall goal of the SNAP program is to ensure that substitutes listed as acceptable do not pose significantly greater risk to human health and the environment than other available substitutes, the SNAP criteria should be informed by our current overall understanding of environmental and human health impacts and our experience with and current knowledge about available and potentially available substitutes. Over time, the range of substitutes reviewed by SNAP has changed, and, at the same time, scientific approaches have evolved to more accurately assess the potential environmental and human health impacts of these chemicals and alternative technologies. The Agency publishes its SNAP program decisions in the Federal Register. EPA uses notice-and-comment rulemaking to place any alternative on the list of prohibited substitutes, to list a substitute as acceptable only subject to use conditions or narrowed use limits, or to remove a substitute from either the list of prohibited or acceptable substitutes.

In contrast, EPA publishes “notices of acceptability” or “determinations of acceptability,” to notify the public of substitutes that are deemed acceptable with no restrictions. As described in the preamble to the rule initially implementing the SNAP program (59 FR 13044; March 18, 1994), EPA does not believe that rulemaking procedures are necessary to list 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 (e.g., worker protection regulations promulgated by OSHA). The “further information” classification does not necessarily include all other legal obligations pertaining to the use of the substitute. While the items listed are not legally binding under the SNAP program, EPA encourages users of substitutes to apply all statements in the “further information” column in their use of these substitutes. In many instances, the information simply refers to sound operating practices that have already been identified in existing industry and/or building codes or standards. Thus many of the statements, if adopted, would not require the affected user to make significant changes in existing operating practices.

D. 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 website at: www.epa.gov/snap. For more information on the agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the initial SNAP rulemaking published March 18, 1994 (59 FR 13044), codified at 40 CFR part 82, subpart G. SNAP decisions and the appropriate Federal Register citations are found at: www.epa.gov/snap/snap-regulations.

List of Subjects in 40 CFR Part 82

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

Date: September 28, 2016.

Sarah Dunham, Director,
Office of Atmospheric Programs.

APPENDIX A: SUMMARY OF DECISIONS FOR NEW ACCEPTABLE SUBSTITUTES

Refrigeration and Air Conditioning

| End-Use | Substitute | Decision | Further Information ¹ |
|--|--------------------------|------------|---|
| Commercial ice machines (<i>new and retrofit equipment</i>). | R-449B (Forane® 449B) | Acceptable | <p>R-449B has a 100-year global warming potential (GWP) of approximately 1,410. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>The blend is nonflammable.</p> <p>The American Industrial Hygiene Association (AIHA) has established workplace environmental exposure limits (WEELs) of 1,000 ppm (8-hr time weighted average (TWA)) for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf. The manufacturer recommends an acceptable exposure level (AEL) for the workplace for R-449B of 865 ppm (8-hr TWA).</p> |
| Refrigerated transport (<i>new and retrofit equipment</i>). | R-449B (Forane® 449B) | Acceptable | <p>R-449B has a 100-year GWP of approximately 1,410. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf. The manufacturer recommends an AEL for the workplace for R-449B of 865 ppm (8-hr TWA).</p> |

| End-Use | Substitute | Decision | Further Information ¹ |
|--|----------------------------|------------|--|
| Retail food refrigeration <i>(new and retrofit refrigerated food processing and dispensing equipment)</i> | R-448A (Solstice® N-40) | Acceptable | <p>R-448A has a 100-yr GWP of approximately 1,390. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); HFO-1234yf, which is also known as 2,3,3,3-tetrafluoro-prop-1-ene (CAS Reg. No. 754-12-1); and HFO-1234ze(E), which is also known as <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; 500 ppm for HFO-1234yf; and 800 ppm for HFO-1234ze(E). The manufacturer recommends an AEL for the workplace for R-448A of 890 ppm (8-hr TWA).</p> |
| Retail food refrigeration <i>(new and retrofit refrigerated food processing and dispensing equipment)</i> | R-449A (Opteon® XP 40) | Acceptable | <p>R-449A has a 100-year GWP of approximately 1,400. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf. The manufacturer recommends an AEL for the workplace for R-449A of 830 ppm (8-hr TWA).</p> |

| End-Use | Substitute | Decision | Further Information ¹ |
|--|--------------------------|------------|--|
| Retail food refrigeration <i>(new and retrofit refrigerated food processing and dispensing equipment)</i> | R-449B (Forane® 449B) | Acceptable | <p>R-449B has a 100-year GWP of approximately 1,410. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf. The manufacturer recommends an AEL for the workplace for R-449B of 865 ppm (8-hr TWA).</p> |
| Retail food refrigeration <i>(supermarket systems, remote condensing units, and low-temperature² stand-alone equipment only, new and retrofit equipment)</i> | R-449B (Forane® 449B) | Acceptable | <p>R-449B has a 100-year GWP of approximately 1,410. This substitute is a blend of HFC-32, which is also known as difluoromethane (CAS Reg. No. 75-10-5); HFC-125, which is also known as 1,1,1,2,2-pentafluoroethane (CAS Reg. No. 354-33-6); HFC-134a, which is also known as 1,1,1,2-tetrafluoroethane (CAS Reg. No. 811-97-2); and HFO-1234yf, which is also known as 2,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 754-12-1).</p> <p>The blend is nonflammable.</p> <p>The AIHA has established WEELs of 1,000 ppm (8-hr TWA) for HFC-32, HFC-125, and HFC-134a; and 500 ppm for HFO-1234yf. The manufacturer recommends an AEL for the workplace for R-449B of 865 ppm (8-hr TWA).</p> |

¹ Observe recommendations in the manufacturer’s SDS and guidance for all listed refrigerants.

² “Low-temperature” refers to equipment that maintains food or beverages at temperatures at or below 32°F (0 °C). See appendix U to 40 CFR part 82, subpart G.

Fire Suppression and Explosion Protection

| End-Use | Substitute | Decision | Further Information |
|----------------|---|------------|--|
| Total flooding | <i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene (Solstice [®] FS) | Acceptable | <p>Use of this agent should be in accordance with the safety guidelines in the latest edition of the National Fire Protection Association (NFPA) 2001 Standard on Clean Agent Fire Extinguishing Systems. Safety features that are typical of total flooding systems such as pre-discharge alarms, time delays, and system abort switches should be provided, as directed by applicable OSHA regulations and NFPA standards.</p> <p>For establishments manufacturing, installing and maintaining equipment using this agent, EPA recommends the following:</p> <ul style="list-style-type: none"> • In the case that Solstice[®] FS is inhaled, person(s) should be immediately removed and exposed to fresh air; if breathing is difficult, person(s) should seek medical attention; • Eye wash and quick drench facilities should be available. In case of ocular exposure, person(s) should immediately flush the eyes, including under the eyelids, with water for 15 minutes; should frostbite occur, affected areas should be rinsed with lukewarm water, and medical attention should be sought if irritation develops or persists; • In the case of dermal exposure, the SDS recommends that person(s) should immediately wash the affected area with water and remove all contaminated clothing to avoid irritation; should frostbite occur, bathe (do not rub) the affected area with lukewarm, no hot, water. If water is not available, cover the affected area with a clean soft cloth; and medical attention should be sought if irritation develops or persists. • Although unlikely, in case of ingestion of Solstice[®] FS, the person(s) should drink a cup of water, if fully conscious, and consult a physician immediately; • Manufacturing space should be equipped with engineering controls, specifically an adequate exhaust ventilation system, to effectively mitigate potential occupational exposure; • Employees responsible for chemical processing should wear the appropriate personal protective equipment (PPE), such as protective gloves, tightly sealed goggles, protective work clothing, and suitable respiratory protection in case of accidental release or insufficient ventilation; • All spills should be cleaned up immediately in accordance with good industrial hygiene practices; • Training for safe handling procedures should be provided to all employees that would be likely to handle containers of the agent or extinguishing units filled with the agent; <p>See additional comments 1, 2, 3, 4, 5.</p> |

1. The EPA recommends that users consult Section VIII of the OSHA Technical Manual for information on selecting the appropriate types of personal protective equipment for all listed fire suppression agents. The EPA has no intention of duplicating or displacing OSHA coverage related to the use of personal protective equipment (e.g., respiratory protection), fire protection, hazard communication, worker training or any other occupational safety and health standard with respect to halon substitutes.
2. Use of all listed fire suppression agents should conform to relevant OSHA requirements, including 29 CFR part 1910, subpart L, sections 1910.160 and 1910.162.
3. Per OSHA requirements, protective gear (SCBA) should be available in the event personnel should reenter the area.
4. Discharge testing should be strictly limited to that which is essential to meet safety or performance requirements.
5. The agent should be recovered from the fire protection system in conjunction with testing or servicing, and recycled for later use or destroyed.

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