



ENVIRONMENTAL PROTECTION AGENCY

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[EPA-HQ-OAR-2003-0118; FRL-9712-4]

RIN 2060-AG12

Protection of Stratospheric Ozone: Determination 27 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 for ozone-depleting substances under the U.S. Environmental Protection Agency's (EPA) Significant New Alternatives Policy (SNAP) program. This action lists as acceptable four additional substitutes for use in the refrigeration and air conditioning sector; two additional substitutes in the foam blowing sector; one additional substitute in the solvent cleaning sector; two additional substitutes in the aerosol sector; and one additional substitute in the fire suppression sector.

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

ADDRESSES: EPA has 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 <http://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 <http://www.regulations.gov> or in hard copy at the EPA Air Docket (No. A-91-42), 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 Docket is (202) 566-1742.

FOR FURTHER INFORMATION CONTACT: Margaret Sheppard by telephone at (202) 343-9163, by facsimile at (202) 343-2338, by e-mail at sheppard.margaret@epa.gov, or by mail at U.S. Environmental Protection Agency, Mail Code 6205J, 1200 Pennsylvania Avenue, NW, Washington, DC 20460. Overnight or courier deliveries should be sent to the office location at 1310 L Street, NW, 10th floor, Washington, DC 20005.

For more information on the Agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the original 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 Depletion Website at <http://www.epa.gov/ozone/strathome.html> including the SNAP portion at <http://www.epa.gov/ozone/snap/>.

SUPPLEMENTARY INFORMATION:

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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 acceptable listing decisions for substitutes in the refrigeration and air conditioning, foam blowing, solvent cleaning, aerosols and fire suppression sectors. For copies of the full list of acceptable substitutes for ozone-depleting substances (ODSs) in all industrial sectors, visit EPA's Ozone Layer Protection web site at <http://www.epa.gov/ozone/snap/lists/index.html>.

The sections below discuss each substitute listing in detail. Appendix A contains tables summarizing today's listing decisions for these new acceptable 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" may not be 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, EPA strongly encourages you to

apply the information when using these substitutes. In many instances, the information simply refers to standard operating practices in existing industry and/or building-code standards. However, some of these statements may refer to obligations that are enforceable or binding under federal or state programs other than the SNAP program. Many of these recommendations, if adopted, would not require significant changes to existing operating practices.

You can find submissions to EPA for the use of the substitutes listed in this document and other materials supporting the decisions in this action in docket EPA-HQ-OAR-2003-0118 at <http://www.regulations.gov>.

A. Refrigeration and Air Conditioning

1. C7 Fluoroketone

EPA's decision: EPA finds C7 Fluoroketone acceptable as a substitute for chlorofluorocarbon (CFC)-113 for use in new and retrofit equipment in non-mechanical heat transfer.

C7 Fluoroketone is marketed under the trade name Novec™ 774 and is also designated as FK-6-1-12. This substitute is a blend of two isomers, 3-pentanone,1,1,1,2,4,5,5,5-octafluoro-2,4-bis(trifluoromethyl) (Chemical Abstracts Service Registry Number [CAS Reg. No.] 813-44-5) and 3-hexanone,1,1,1,2,4,4,5,5,6,6,6-undecafluoro-2-(trifluoromethyl) (CAS Reg. No. 813-45-6). You may find the redacted submission under Docket item EPA-HQ-OAR-2003-0118-0287 at <http://www.regulations.gov>.

Environmental information: C7 Fluoroketone has no ozone depletion potential

(ODP). C7 Fluoroketone has a 100-year integrated (100-yr) global warming potential (GWP) of about 1.¹ C7 Fluoroketone is considered a volatile organic compound (VOC) under Clean Air Act (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). The emissions of this refrigerant will be limited given it is subject to the venting prohibition under section 608(c)(2) of the CAA and EPA's implementing regulations codified at 40 CFR 82.154(a)(1).

Flammability information: C7 Fluoroketone is not flammable.

Toxicity and exposure data: Potential health effects of this substitute include respiratory tract irritation and symptoms may include coughing, sneezing, nasal discharge, headache, hoarseness, and nose and throat pain. Contact with the eyes or skin during product use is not expected to result in significant irritation. Ingestion of C7 Fluoroketone is not expected to cause health effects, and there is no anticipated need for first aid if C7 Fluoroketone contacts the eyes or skin or if C7 Fluoroketone is ingested.

EPA anticipates that C7 Fluoroketone will be used consistent with the recommendations specified in the manufacturer's material safety data sheet (MSDS). The manufacturer recommends an acceptable exposure limit (AEL) for the workplace of 225 ppm over an eight-hour time-weighted average (8-hr TWA) for C7 Fluoroketone. EPA anticipates that users will be able to meet the manufacturer's recommended workplace exposure limit and address potential health risks by following requirements and

¹ TSCA SNAP Addendum Form to EPA for C7 Fluoroketone. February 22, 2010.

recommendations in the MSDS and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other refrigerants: C7 Fluoroketone is not ozone-depleting, comparable to a number of other acceptable non-ozone-depleting substitutes for this end use such as hydrofluoroether (HFE)-7100, hydrofluorocarbon (HFC)-245fa and CO₂ and in contrast to CFC-113 (with an ODP of 1.0 relative to CFC-11), the ozone-depleting substance (ODS) which it replaces.² C7 Fluoroketone's GWP of about 1 is lower than or comparable to that of other non-ozone-depleting substitutes in heat transfer uses, such as HFE-7100 with a GWP of 297, HFC-245fa with a GWP of 1030, and CO₂ with a GWP of 1.³ Furthermore, the GWP of C7 Fluoroketone is well below that of CFC-113, the ODS it is replacing (with a GWP of 6130). Flammability and toxicity risks are low, as discussed above. The potential health effects of C7 Fluoroketone are common to many refrigerants, including many of those already listed as acceptable under SNAP. Thus, EPA finds C7 Fluoroketone acceptable in the end use listed above because the overall environmental and human health risk posed by C7 Fluoroketone is lower than or comparable to the risks posed by other substitutes found acceptable in the same end use.

2. *Trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E))

² Unless otherwise stated, all ODPs in this document are from WMO (World Meteorological Organization), 2011. Scientific Assessment of Ozone Depletion: 2010, Global Ozone Research and Monitoring Project—Report No. 52, 516 pp., Geneva, Switzerland, 2011. This document is accessible at http://www.wmo.int/pages/prog/arep/gaw/ozone_2010/ozone_asst_report.html.

³ Unless otherwise stated, all GWPs in this document are from: IPCC, 2007: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. This document is accessible at http://www.ipcc.ch/publications_and_data/ar4/wg1/en/contents.html

EPA's decision: EPA finds trans-1-chloro-3,3,3-trifluoroprop-1-ene acceptable as a substitute for CFC-11 and hydrochlorofluorocarbon (HCFC)-123 for use in new equipment in centrifugal chillers.

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 names Solstice™ 1233zd(E) and Solstice™ N12 Refrigerant for this end use. You may find the redacted submission under Docket item EPA-HQ-OAR-2003-0118-0285 at <http://www.regulations.gov>.

Environmental information: Solstice™ 1233zd(E) has an ODP of 0.00024 to 0.00034.^{4,5} Estimates of this compound's potential to deplete the ozone layer found that even with worst-case estimates of emissions which assume that this compound would substitute for all compounds it could replace, the impact on global atmospheric ozone abundance would be statistically insignificant.⁶ Solstice™ 1233zd(E) has a 100-yr GWP reported as 4.7 to 7 and an atmospheric lifetime of approximately 26 to 31 days or less.^{7,8} Solstice™ 1233zd(E) is currently considered a VOC under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. The manufacturer has petitioned EPA to exempt Solstice™ 1233zd(E) from that definition

⁴ 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.

⁵ 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.

⁶ Wang et al., 2011. *Op. cit.*

⁷ Sulbaek Andersen, Nilsson, Neilsen, Johnson, Hurley and Wallington, "Atmospheric chemistry of trans-CF₃CH=CHCl: Kinetics of the gas-phase reactions with Cl atoms, OH radicals, and O₃", *Jrnl of Photochemistry and Photobiology A: Chemistry* 199 (2008) 92-97; and Wang D., Olsen S., Wuebbles D. Undated. "Three-Dimensional Model Evaluation of the Global Warming Potentials for tCFP." Department of Atmospheric Sciences. University of Illinois, Urbana, IL. Draft report, undated.

⁸ Wang et al. 2011 and Sulbaek Andersen et al., 2008. *Op cit.*

based on its claim that the chemical exhibits low photochemical reactivity. The emissions of this refrigerant will be limited given it is subject to the venting prohibition under section 608(c)(2) of the CAA and EPA's implementing regulations codified at 40 CFR 82.154(a)(1).

Flammability information: Solstice™ 1233zd(E) 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.

EPA anticipates that Solstice™ 1233zd(E) will be used consistent with the recommendations specified in the manufacturer's MSDS. The manufacturer recommends an AEL of 300 ppm (8-hr TWA) for Solstice™ 1233zd(E). EPA anticipates that users will be able to meet the manufacturer's recommended workplace exposure limit and address potential health risks by following requirements and recommendations in the MSDS and in any other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other refrigerants: Solstice™ 1233zd(E) has an ODP of 0.00024 to 0.00034. This is roughly one order of magnitude higher than the ODPs of HFCs used in substitute refrigerants which are considered to have zero ODP, including HFC-134a and HFC-125.⁹ Solstice™ 1233zd(E)'s ODP is well below that of CFC-11 and HCFC-123 (with ODPs ranging from 0.01 to 1.0), the ODSs which it replaces. Solstice™

⁹ The ODP of HFC-134a was estimated to be less than 1.5×10^{-5} and the ODP of HFC-125 was estimated to be less than 3.0×10^{-5} using a theoretical 2-dimensional model. Ravishankara, A. R., A. A. Turnipseed, N. R. Jensen, S. Barone, M. Mills, C. J. Howard, and S. Solomon. 1994. Do hydrofluorocarbons destroy stratospheric ozone? *Science* 263: 71-75.

1233zd(E)'s GWP of 4.7 to 7 is lower than or comparable to that of other acceptable substitutes in the same end uses, such as HFC-134a with a GWP of 1430, HFC-245fa with a GWP of 1030, and ammonia with a GWP of 0. Its GWP is also well below those of CFC-11 and HCFC-123 (with GWPs ranging from 77 to 4750). Flammability and toxicity risks are low, as discussed above. The potential health effects of Solstice™ 1233zd(E) are common to many refrigerants, including many of those already listed as acceptable under SNAP. Thus, EPA finds *trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E)) acceptable in the end use listed above because the overall environmental and human health risk posed by *trans*-1-chloro-3,3,3-trifluoroprop-1-ene is lower than or comparable to the risks posed by other substitutes found acceptable in the same end use.

3. Carbon dioxide (R-744)

EPA's decision: EPA finds carbon dioxide (CO₂ or R-744) acceptable as a substitute for CFC-12, HCFC-22 and blends containing HCFC-22 and/or HCFC-142b, and R-502¹⁰ for use in new equipment in vending machines.

Carbon dioxide is also known as CO₂, CAS Reg. No. 124-38-9, or R-744 when used as a refrigerant. We have previously listed CO₂ as a refrigerant in other refrigeration and air conditioning end uses (e.g., 77 FR 33315, June 6, 2012; 74 FR 50129, September 30, 2009; 60 FR 3318, January 13, 1995). You may find the redacted submission under docket item EPA-HQ-OAR-2003-0118-0283 at <http://www.regulations.gov>.

Environmental information: CO₂ has no ODP. The 100-yr GWP of CO₂ is 1.

¹⁰ R-502 is a refrigerant blend containing 51.2% CFC-115 and 48.8% HCFC-22 by weight.

EPA's regulations codified at 40 CFR part 82, subpart F exempt CO₂ refrigerant from the venting prohibition under section 608(c)(2) of the Clean Air Act (see 69 FR 11946; March 12, 2004). This section and EPA's implementing regulations prohibit the intentional venting or release of substitutes for class I or class II ODSs during the repair, maintenance, service or disposal of refrigeration and air conditioning appliances, unless EPA expressly exempts a particular substitute refrigerant from the venting prohibition, as we have done for CO₂.

CO₂ is excluded from the definition of VOC under Clean Air Act regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

Flammability information: CO₂ is not flammable.

Toxicity and exposure data: Potential health effects of this substitute at lower concentrations include loss of concentration, headache and shortness of breath. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, it may cause central nervous system depression. The substitute could cause asphyxiation, if air is displaced by vapors in a confined space. For additional information concerning potential health risks of CO₂, see EPA's final rule under the SNAP program for use of CO₂ as a refrigerant in motor vehicle air conditioning systems (77 FR 33315, June 6, 2012). Also, 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 CFC-12 and R-502 in Vending Machines Substitute: Carbon Dioxide." To protect against these

potential health risks, CO₂ has an 8 hour/day, 40 hour/week permissible exposure limit (PEL) of 5000 ppm in the workplace required by the Occupational Safety and Health Administration (OSHA) and a 15-minute recommended short-term exposure limit (STEL) of 30,000 ppm established by the National Institute for Occupational Safety and Health (NIOSH). EPA recommends that users follow all requirements and recommendations specified in the MSDS, in American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standard 15, and other safety precautions common in the refrigeration and air conditioning industry. Based on the Risk Screen analysis described above, we recommend installing vending machines using CO₂ in well-ventilated spaces and avoiding confined spaces with poor ventilation. We also recommend that users of CO₂ adhere to NIOSH's STEL and to ASHRAE 15, and we expect that users will meet OSHA's PEL. EPA anticipates that users will be able to address potential health risks by following requirements and recommendations in the MSDS, in ASHRAE 15, and other safety precautions common in the refrigeration and air conditioning industry.

Comparison to other refrigerants: CO₂ is not ozone-depleting, comparable to a number of other acceptable non-ozone-depleting substitutes for these end uses, including R-404A, R-407C, R-410A, and HFC-134a, and in contrast to the ODSs CFC-12, HCFC-22 and R-502 (with ODPs ranging from 0.04 to 1.0) which it replaces. CO₂'s GWP of 1 is lower than or comparable to that of other non-ozone-depleting substitutes in the same refrigeration and air conditioning end use for which we are finding it acceptable, such as R-404A with a GWP of about 3930, R-407C with a GWP of about 1770, R-410A with a

GWP about 2090, and HFC-134a with a GWP about 1430. Furthermore, the GWP of CO₂ is well below those of the ODSs it is replacing, including CFC-12, HCFC-22 and R-502 (with GWPs ranging from 1810 to 10,900). Flammability risks are low, as discussed above. Toxicity risks can be minimized by use consistent with industry standards, recommendations in the MSDS, and other safety precautions common in the refrigeration and air conditioning industry. The potential health effects of CO₂ are common to many refrigerants, including many of those already listed as acceptable under SNAP. Thus, EPA finds CO₂ acceptable in the end uses listed above because the overall environment and human health risk posed by CO₂ is lower than or comparable to the risks posed by other substitutes found acceptable in the same end uses.

4. HFO-1234ze

EPA's decision: EPA finds hydrofluoroolefin¹¹ (HFO)-1234ze is acceptable as a substitute for:

- CFC-12, R-500, HCFC-22 and blends containing HCFC-22 and/or HCFC-142b for use in new equipment in reciprocating, screw and scroll chillers
- CFC-11 and HCFC-123 for use in new equipment in centrifugal chillers

HFO-1234ze is also known as HFC-1234ze, HFO-1234ze(E) or *trans*-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9). It is sold under the trade name Solstice™ 1234ze. We have previously listed HFO-1234ze as an acceptable substitute for a number of foam blowing end uses, as an aerosol propellant, and as a refrigerant for heat transfer (74 FR 50129, September 30, 2009; 75 FR 34017, June 16, 2010). You may find the submission under Docket item EPA-HQ-OAR-2003-0118-0282 at

¹¹ Hydrofluoroolefins are a subset of hydrofluorocarbons that contain double bonds between carbon atoms.

<http://www.regulations.gov>.

Environmental information: HFO-1234ze has no ODP. HFO-1234ze has a 100-yr GWP of 6¹² and an atmospheric lifetime of approximately 2 weeks. HFO-1234ze is exempted 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 (June 22, 2012; 77 FR 37610). The emissions of this refrigerant will be limited given it is subject to the venting prohibition under section 608(c)(2) of the CAA and EPA's implementing regulations codified at 40 CFR 82.154(a)(1).

Flammability information: HFO-1234ze is non-flammable at standard temperature and pressure using the standard test method ASTM E681. However, at higher temperatures it is mildly flammable. It is classified as a Class 2L (lower flammability, low burning velocity) refrigerant under the standard ASHRAE 34 (2010).

Toxicity and exposure data: Potential health effects of this substitute at lower concentrations include headache, nausea, drowsiness and dizziness. The substitute may also irritate the skin or eyes or cause frostbite. At sufficiently high concentrations, it may cause central nervous system depression and affect respiration. The substitute could cause asphyxiation, if air is displaced by vapors in a confined space.

EPA anticipates that HFO-1234ze will be used consistent with the recommendations specified in the manufacturer's MSDS. The American Industrial Hygiene Association (AIHA) recommends a workplace environmental exposure limit (WEEL) of 800 ppm (8-hr TWA) for HFO-1234ze. EPA anticipates that users will be

¹² "Atmospheric chemistry of trans-CF₃CH=CHF: products and mechanisms of hydroxyl radical and chlorine atom initiated oxidation, M. S. Javadi, R. Søndergaard, O.J. Nielsen, M. D. Hurley, and T.J. Wellington, *Atmospheric Chemistry and Physics Discussions* 8, 1069-1088, 2008

able to meet the workplace exposure limit (WEEL) and address potential health risks by following requirements and recommendations in the MSDS and other safety precautions common to the refrigeration and air conditioning industry.

Comparison to other refrigerants: HFO-1234ze is not ozone-depleting, comparable to a number of other acceptable non-ozone-depleting substitutes for these end uses such as R-407C, HFC-134a and ammonia, and in contrast to CFC-12, HCFC-22 and R-500 (with ODPs ranging from 0.04 to 1.0), the ODSs which it replaces. HFO-1234ze's GWP of about 6 is lower than or comparable to that of other non-ozone-depleting substitutes in the same refrigeration and air conditioning end uses for which we are finding it acceptable, such as R-407C with a GWP about 1770, HFC-134a with a GWP about 1430, and ammonia with a GWP of zero. HFO-1234ze's GWP is well below that of the ODSs it replaces, including CFC-12, HCFC-22 and R-500 with GWPs ranging from 1810 to 10,900. Flammability and toxicity risks are low, as discussed above. The potential health effects of HFO-1234ze are common to many refrigerants, including many of those already listed as acceptable under SNAP. Thus, EPA finds HFO-1234ze acceptable in the end uses listed above because the overall environmental and human health risk posed by HFO-1234ze is lower than or comparable to the risks posed by other substitutes found acceptable in the same end uses.

B. Foam Blowing

1. *Trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ Liquid Blowing Agent)

EPA's decision: EPA finds trans-1-chloro-3,3,3-trifluoroprop-1-ene is acceptable as a substitute for CFC-11 and HCFC-141b in:

- Rigid polyurethane and polyisocyanurate laminated boardstock
- Rigid polyurethane appliance
- Rigid polyurethane spray, commercial refrigeration and sandwich panels
- Rigid polyurethane slabstock and other
- Integral skin polyurethane

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 names Solstice™ 1233zd(E), Solstice™ Liquid Blowing Agent or Solstice™ LBA in these end uses. You may find the redacted submission under Docket item EPA-HQ-OAR-2003-0118-0285 at <http://www.regulations.gov>.

Environmental information: The environmental information for this substitute is set forth in the “Environmental information” section in listing A.2.

Flammability information: Solstice™ 1233zd(E) is not flammable.

Toxicity and exposure data: The toxicity information for this substitute is set forth in the “Toxicity and exposure data” section in listing A.2.

EPA anticipates that Solstice™ 1233zd(E) will be used consistent with the recommendations specified in the manufacturer's MSDS. The manufacturer recommends an AEL of 300 ppm (8-hr TWA) for Solstice™ 1233zd(E). EPA anticipates that users will be able to meet the manufacturer’s recommended workplace exposure limit and address potential health risks by following requirements and recommendations in the MSDS and in other safety precautions common to the foam blowing industry.

Comparison to other foam blowing agents: Solstice™ 1233zd(E) has an ODP of 0.00024 to 0.00034. This is roughly one order of magnitude higher than the ODP of HFC-134a, a substitute foam blowing agent which is considered to have zero ODP.¹³ Solstice™ 1233zd(E)'s ODP is well below that of CFC-11 and HCFC-141b (with ODPs ranging from 0.12 to 1.0), the ODSs which it replaces. Solstice™ 1233zd(E)'s GWP of 4.7 to 7 is lower than or comparable to that of other non-ozone-depleting substitutes in the same foam blowing end uses for which we are finding it acceptable, such as HFC-245fa with a GWP of 1030, HFC-365mfc with a GWP of 794 and C3-C6 saturated light hydrocarbons with GWPs less than 10. Furthermore, Solstice™ 1233zd(E)'s GWP is well below that of CFC-11 and HCFC-141b (with GWPs ranging from 725 to 4750). Flammability and toxicity risks are low, as discussed above. The potential health effects of Solstice™ 1233zd(E) are common to many foam blowing agents, including many of those already listed as acceptable under SNAP. Thus, EPA finds *trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E)) acceptable in the end uses listed above because the overall environmental and human health risk posed by *trans*-1-chloro-3,3,3-trifluoroprop-1-ene is lower than or comparable to the risks posed by other substitutes found acceptable in the same end uses.

2. Formacel® Z-6

EPA's decision: EPA finds Formacel® Z-6 is acceptable as a substitute for HCFC-22, HCFC-142b or blends thereof in:

- Polystyrene extruded boardstock & billet

¹³ The ODP of HFC-134a was estimated to be less than 1.5×10^{-5} using a theoretical 2-dimensional model. Ravishankara et al. 1994. *Op. cit.*

- Polystyrene extruded sheet
- Rigid polyurethane appliance foam
- Rigid polyurethane commercial refrigeration and sandwich panels
- Integral skin polyurethane
- Rigid polyurethane slabstock and other

Formacel® Z-6 is a series of blends with different percentage contents of the same compounds. The submitter has claimed its composition as confidential business information (CBI). You may find the redacted submission under Docket item EPA-HQ-OAR-2003-0118-0284 at <http://www.regulations.gov>.

Environmental information: Formacel® Z-6 has no ODP. Formacel® Z-6 blends range in GWP from approximately 370 to 1290. Formacel® Z-6 does not contain VOCs as defined under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

Flammability information: Some components of the Formacel® Z-6 blends are flammable. Some specific blends are flammable as formulated and should be handled with proper precautions, as specified by the manufacturer. EPA recommends that users follow all requirements and recommendations specified in the MSDS and other safety precautions for use of flammable blowing agents used in the foam blowing industry. Use of Formacel® Z-6 will require safe handling and shipping as prescribed by OSHA and the Department of Transportation (for example, using personal safety equipment and following requirements for shipping hazardous materials at 49 CFR parts 170 through 173).

Toxicity and exposure data: Potential health effects of this substitute include nausea, headache, weakness, or central nervous system depression with effects such as dizziness, drowsiness, confusion, or loss of consciousness. The substitute may also irritate the lungs, skin or eyes or cause frostbite. At high concentrations, the substitute may cause irregular heartbeat. The substitute could cause asphyxiation, if air is displaced by vapors in a confined space. EPA anticipates that Formacel® Z-6 will be used consistent with the recommendations specified in the manufacturer's MSDS. The manufacturer recommends an AEL of 1000 ppm (8-hr TWA) for Formacel® Z-6. The AIHA has established a WEEL of 1000 ppm (8-hr TWA) for at least one of the components of Formacel® Z-6. EPA anticipates that users will be able to meet the manufacturer's recommended workplace exposure limit (AEL) and any AIHA WEELs for components and will be able to address potential health risks by following requirements and recommendations in the MSDS and other safety precautions common in the foam blowing industry.

Comparison to other foam blowing agents: Formacel® Z-6 is not ozone-depleting, comparable to a number of other acceptable non-ozone-depleting substitutes for these end uses, such as HFC-134a, HFC-245fa and C3-C6 saturated light hydrocarbons, and in contrast to HCFC-142b and HCFC-22 (with ODPs ranging from 0.04 to 0.06), the ODSs which it replaces. Formacel® Z-6 blends range in GWP from 370 to 1290, lower than or comparable to those of other non-ozone-depleting substitutes in the same foam blowing end uses for which we are finding it acceptable, such as HFC-134a with a GWP of 1430 and HFC-245fa with a GWP of 1030. Furthermore, the GWP

of Formacel® Z-6 is lower than or comparable to that of the ODSs it replaces, including HCFC-142b and HCFC-22, with GWPs ranging from 1810 to 2310. Like many other substitutes in this end use, such as HFC-365mfc or C3-C6 saturated light hydrocarbons, flammability risks can be addressed by procedures common in the industry. The toxicity risks are low, as discussed above. The potential health effects of Formacel® Z-6 are common to many foam blowing agents, including many of those already listed as acceptable under SNAP. Thus, EPA finds Formacel® Z-6 acceptable in the end uses listed above because the overall environmental and human health risk posed by Formacel® Z-6 is lower than or comparable to the risks posed by other substitutes found acceptable in the same end uses.

C. Solvent Cleaning

1. HFE-347pcf2

EPA's decision: EPA finds HFE-347pcf2 acceptable as a substitute for CFC-113, methyl chloroform, and HCFC-225ca, HCFC-225cb, and blends thereof for use in:

- Electronics cleaning
- Precision cleaning

HFE-347pcf2 is also known as 2,2,2-trifluoroethoxy-1,1,2,2-tetrafluoroethane (CAS Reg. No. 406-78-0). It is marketed under the trade name AE-3000. You may find the redacted submission under Docket item EPA-HQ-OAR-2003-0118-0280 at <http://www.regulations.gov>.

Environmental information: HFE-347pcf2 has no ODP. HFE-347pcf2 has a 100-year GWP of 580 and an atmospheric lifetime of 7.1 years. HFE-347pcf2 is currently

defined as a VOC under Clean Air Act regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS. The manufacturer has petitioned EPA to exempt HFE-347pcf2 from that definition based on its claim that the chemical exhibits low photochemical reactivity. Many states, in particular those with areas that are not attaining the NAAQS for ozone, currently have regulations governing the VOC content of solvents.

Flammability information: HFE-347pcf2 is not flammable.

Toxicity and exposure data: Potential health effects of this substitute include coughing, dizziness, dullness, drowsiness, and headache. Higher concentrations can produce heart irregularities, central nervous system depression, narcosis, unconsciousness, respiratory failure, or death. The substitute may also irritate the skin or eyes.

An assessment was performed 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 CFC-113, Methyl Chloroform, and HCFC-141b in Aerosol Solvent, Electronics Cleaning, and Precision Cleaning Substitute: HFE-347pcf2.” Based on this analysis, EPA anticipates that users will be able to use HFE-347pcf2 in electronics and precision cleaning without appreciable health risks. EPA anticipates that HFE-347pcf2 will be used consistent with the recommendations specified in the MSDS. The manufacturer recommends an AEL of 50 ppm (8-hr TWA). EPA recommends a ceiling limit¹⁴ of 150 ppm for HFE-347pcf2. EPA anticipates that users

¹⁴ A ceiling limit is a concentration of a chemical that no person should be exposed to for any period of time in order to prevent adverse health effects.

will be able to meet the workplace exposure limits (manufacturer and EPA recommendations) based on the risk screen mentioned above. We expect that users will address potential health risks by following requirements and recommendations in the MSDS and other safety precautions common in the solvent cleaning industry.

Comparison to other solvents: HFE-347pcf2's ODP of zero is less than or comparable to that of other substitutes in electronics and precision cleaning such as perfluorobutyl iodide with an ODP of less than 0.005 and HFC-4310mee, HFE-7100 and aqueous cleaners with no ODP. Its ODP is significantly below those of methyl chloroform, CFC-113, HCFC-225ca and HCFC-225cb (with ODPs ranging from 0.02 to 0.85), the ODSs it replaces. HFE-347pcf2's GWP of 540 is lower than that of some other substitutes in the listed end uses, such as HFC-4310mee with a GWP of 1640, but higher than the GWP of some other substitutes, such as HFE-7100 with a GWP of 297 and aqueous cleaners with no direct GWP. Flammability risks are low and toxicity risks will be addressed when used according to recommendations in the MSDS and other safety precautions common in the solvent cleaning industry, as discussed above. The potential health effects of HFE-347pcf2 are common to many solvents, including many of those already listed as acceptable under SNAP. Thus, EPA finds HFE-347pcf2 acceptable in the end uses listed above because the overall risk to human health and the environment posed by HFE-347pcf2 is lower than or comparable to the risks posed by other substitutes found acceptable in the same end uses.

D. Aerosols

1. HFE-347pcf2

EPA's decision: EPA finds HFE-347pcf2 acceptable as a substitute for CFC-113, methyl chloroform, HCFC-141b, and HCFC-225ca, HCFC-225cb, and blends thereof for use as an aerosol solvent.

HFE-347pcf2 is also known as 2,2,2-Trifluoroethoxy-1,1,2,2-tetrafluoroethane (CAS Reg. No. 406-78-0). It is marketed under the trade name AE-3000. You may find the redacted submission under Docket item EPA-HQ-OAR-2003-0118-0280 at <http://www.regulations.gov>.

Environmental information: The environmental information for this substitute is set forth in the “Environmental information” section in listing C.1.

Flammability information: HFE-347pcf2 is not flammable.

Toxicity and exposure data: The toxicity information for this substitute is set forth in the “Toxicity and exposure data” section in listing C.1.

EPA anticipates that HFE-347pcf2 will be used consistent with the recommendations specified in the manufacturer's MSDS. The manufacturer recommends an AEL of 50 ppm (8-hr TWA). EPA recommends a ceiling limit of 150 ppm for HFE-347pcf2.

An assessment was performed 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 CFC-113, Methyl Chloroform, and HCFC-141b in Aerosol Solvent, Electronics Cleaning, and Precision Cleaning Substitute: HFE-347pcf2.” Based on this analysis, we recommend using this compound as an aerosol solvent with adequate ventilation and following good industrial hygiene practice due to

the potential neurotoxic effects of this substitute at high acute (short-term) concentrations. EPA anticipates that users will be able to meet the workplace exposure limits (manufacturer and EPA recommendations) and address potential health risks by following requirements and recommendations in the MSDS and other safety precautions common during use of aerosol solvents.

Comparison to other aerosol solvents: HFE-347pcf2 is not ozone-depleting, comparable to that of a number of acceptable non-ozone depleting substitutes for the aerosol solvent end use such as HFC-4310mee, HFE-7100 and *trans*-dichloroethylene, and in contrast to methyl chloroform, CFC-113, HCFC-141b, HCFC-225ca and HCFC-225cb (with ODPs ranging from 0.02 to 0.85), the ODSs it replaces. HFE-347pcf2's GWP of 540 is lower than that of some other substitutes for CFC-113 in the listed end use, such as HFC-4310mee with a GWP of 1640, but higher than the GWP of some other substitutes, such as HFE-7100 with a GWP of 297 and *trans*-dichloroethylene with a GWP less than 10. Its GWP is well below that of CFC-113 with a GWP of 6130, comparable to that of HCFC-141b and HCFC-225cb with GWPs of 717 and 606, and higher than those for methyl chloroform and HCFC-225ca (with GWPs of 146 and 122). Flammability risks are low, as discussed above. Toxicity risks can be managed when the guidelines in the manufacturer's MSDS and other safety precautions common during use of aerosol solvents in industry are followed. The potential health effects of HFE-347pcf2 are common to many solvents, including many of those already listed as acceptable under SNAP. Thus, EPA finds HFE-347pcf2 acceptable in the end use listed above because the

overall risk to human health and the environment posed by HFE-347pcf2 is lower than or comparable to the risks posed by other substitutes found acceptable in the same end use.

2. *Trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E))

EPA's decision: EPA finds trans-1-chloro-3,3,3-trifluoroprop-1-ene acceptable as a substitute for CFC-113, methyl chloroform, HCFC-141b, and HCFC-225ca, HCFC-225cb, and blends thereof for use as an aerosol solvent.

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 marketed under the trade names Solstice™ 1233zd(E) and Solstice™ Performance Fluid in this end use. You may find the redacted submission under Docket item EPA-HQ-OAR-2003-0118-0285 at <http://www.regulations.gov>.

Environmental information: The environmental information for this substitute is set forth in the “Environmental information” section in listing A.2.

Flammability information: Solstice™ 1233zd(E) is not flammable.

Toxicity and exposure data: The toxicity information for this substitute is set forth in the “Toxicity and exposure data” section in listing A.2.

EPA anticipates that Solstice™ 1233zd(E) will be used consistent with the recommendations specified in the manufacturer's MSDSs. The manufacturer recommends an AEL of 300 ppm (8-hr TWA) for Solstice™ 1233zd(E). EPA anticipates that users will be able to meet the manufacturer's recommended workplace exposure limit (AEL) and address potential health risks by following requirements and recommendations in the MSDS and other safety precautions common during use of aerosol solvents.

Comparison to other aerosol solvents: Solstice™ 1233zd(E) has an ODP of 0.00024 to 0.00034. This is comparable to the ODPs of *trans*-1,2-dichloroethylene and trichloroethylene and an order of magnitude lower than the ODP of perchloroethylene, other substitutes in the aerosol solvents end use that are not regulated as ODS.^{15,16} Solstice™ 1233zd(E)'s ODP is well below those of methyl chloroform, CFC-113, HCFC-141b, HCFC-225ca and HCFC-225cb (with ODPs ranging from 0.02 to 0.85), the ODSs it replaces. Solstice™ 1233zd(E)'s GWP of 4.7 to 7 is lower than or comparable to that of other substitutes in the aerosol solvent end use, such as HFC-4310mee with a GWP of 1640, HFE-7100 with a GWP of 297 and *trans*-dichloroethylene with a GWP less than 10. Furthermore, the GWP of Solstice™ 1233zd(E) is well below those of the ODSs being replaced, including CFC-113, methyl chloroform, HCF-141b, HCFC-225ca and HCFC-225cb, with GWPs ranging from 122 to 6130. Flammability and toxicity risks are low, as discussed above. The potential health effects of Solstice™ 1233zd(E) are common to many solvents, including many of those already listed as acceptable under SNAP. Thus, EPA finds *trans*-1-chloro-3,3,3-trifluoroprop-1-ene (Solstice™ 1233zd(E)) acceptable in the end use listed above because the overall environmental and human health risk posed by *trans*-1-chloro-3,3,3-trifluoroprop-1-ene is lower than or comparable to the risks posed by other substitutes found acceptable in the same end use.

E. Fire Suppression

1. Cold Fire® (Surfactant Blend A)

¹⁵ Wuebbles and Patten, 2010. Atmospheric lifetimes and Ozone Depletion Potentials of *trans*-1-chloro-3,3,3-trifluoropropylene and *trans*-1,2-dichloroethylene in a three-dimensional model. *Atmos. Chem. Phys.*, 10, 10867–10874, 2010.

¹⁶ WMO, 2010. Section 1.3.6.2.

EPA's decision: EPA finds Cold Fire[®] (Surfactant Blend A) is acceptable as a substitute for halon 1301 for total flooding uses in both occupied and unoccupied areas.

Cold Fire[®] is a liquid fire suppression agent. The manufacturer of Cold Fire[®] has claimed its composition as CBI. You may find the redacted submission under Docket item EPA-HQ-OAR-2003-0118-0288 at <http://www.regulations.gov>. EPA previously listed "Surfactant Blend A," a blend consistent with the composition of Cold Fire[®], as an acceptable substitute for halon 1211 in the streaming end use (March 18, 1994; 59 FR 13044).

Environmental information: Cold Fire[®] has no ODP and no GWP. Cold Fire[®] does not contain any VOCs as defined under CAA regulations (see 40 CFR 51.100(s)) addressing the development of SIPs to attain and maintain the NAAQS.

Cold Fire[®] is expected to aerosolize rapidly during expulsion from the fire suppression system and then settle as a liquid on surfaces in the space being protected, rather than becoming airborne and moving to surface waters. After settling, cleanup would involve washing or rinsing of surfaces.

Cold Fire is not biodegradable. During cleanup, we recommend that discharges of Cold Fire[®] be collected (e.g., mopped) and sealed in containers and then disposed of in accordance with local, state, and federal requirements and as specified in the manufacturer's MSDS. EPA recommends that discharges of Cold Fire[®] not be released to waterways. The MSDS also specifies that training for safe handling procedures be provided to all employees that would be likely to dispose of Cold Fire[®] at cleanup. EPA anticipates that users will be able to avoid potential risks to water and aquatic life by

following requirements and recommendations in the MSDS.

Flammability information: Cold Fire® is non-flammable.

Toxicity and exposure data: The majority of the constituents in the Cold Fire® formulation are classified by the U.S. Food and Drug Administration (FDA) as “generally recognized as safe” (GRAS) compounds, and the remaining constituents are FDA-approved for use as direct or indirect food additives. These compounds are commonly used in food, pharmaceutical, or cosmetic applications. Individual constituents may cause gastrointestinal discomfort (if excessively ingested) or minor irritation to the eyes, skin, and/or respiratory tract. Given the low toxicity of its constituents, EPA expects no adverse health effects when the recommended safety precautions and normal industry practices are applied and use of the substitute is in accordance with the manufacturer’s MSDS. To minimize worker exposure to any chemicals during manufacture, installation, and maintenance through an accidental release or spill, EPA recommends the following:

- proper Level C or higher personal protective equipment (PPE) be used during handling of the substitute (e.g., goggles, gloves);
- adequate ventilation should be in place;
- all spills should be cleaned up immediately in accordance with good industrial hygiene practices;
- after spill and cleanup, dispose of material(s) contaminated with Cold Fire® in accordance with local, state and federal laws;
- training for safe handling procedures should be provided to all employees that would be likely to handle containers of Cold Fire®; and

- in case of an inadvertent discharge, workers should immediately follow the instructions listed in the MSDS for Cold Fire[®].

The above recommendations are all included in the manufacturer's MSDS. EPA anticipates that users will be able to address potential health risks by following requirements and recommendations in the MSDS and other safety precautions common during use of fire suppressants in industry.

Comparison to other fire suppressants: Cold Fire[®] has no ODP or GWP in contrast to halon 1301 (with an ODP of 16 and a GWP of 7140), the ODS which it replaces. Cold Fire[®]'s ODP of zero and GWP of zero are comparable to or less than those of other acceptable non-ozone-depleting substitutes for this end use, such as Inert Gas 541 with a GWP of 0, HFC-227ea with a GWP of 3220 and HFC-125 with a GWP of 3500. Toxicity risks are low, as discussed above. Thus, EPA finds Cold Fire[®] (Surfactant Blend A) acceptable in the end use listed above because the overall environmental and human health risk posed by Cold Fire[®] is lower than or comparable to the risks posed by other substitutes found acceptable in the same end use.

II. Section 612 Program

A. 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 (ODSs). 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 (chlorofluorocarbon, halon, carbon tetrachloride, methyl chloroform, and hydrobromofluorocarbon) or class II substance (hydrochlorofluorocarbon) 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 may be 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” substitutes are found in the appendices to subpart G of 40 CFR part 82.

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 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 (subpart G of 40 CFR part 82). These sectors - refrigeration and air conditioning; foam blowing; cleaning solvents; fire suppression and explosion protection; sterilants; aerosols; adhesives, coatings and inks; and tobacco expansion - are 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 notice to the Agency, including 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). This requirement applies to the persons planning to introduce the substitute into interstate commerce,¹⁷ which typically are chemical manufacturers but may include importers, formulators, equipment manufacturers, and end-users when they are responsible for introducing a substitute into commerce.¹⁸ 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 substitutes that are submitted for evaluation: acceptable; acceptable subject to use conditions; acceptable

¹⁷ 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.

¹⁸ 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.

subject to narrowed use limits; and unacceptable¹⁹ (40 CFR 82.180(b)). Use conditions and narrowed use limits are both considered “use restrictions” and are explained below. Substitutes that are deemed acceptable 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.

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

¹⁹ The SNAP regulations also include “pending,” referring to submissions for which EPA has not reached a determination, under this provision.

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 substitutes deemed unacceptable, as proposed rulemakings to provide the public with an opportunity to comment, before publishing final decisions.

In contrast, EPA publishes decisions concerning substitutes that are deemed acceptable with no restrictions in “notices of acceptability” or “determinations of acceptability,” rather than as proposed and final rules. 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 the Occupational Safety and Health Administration (OSHA)). The “Further Information” classification does not necessarily include all other legal obligations pertaining to the use of the substitute. While the items listed are not legally binding under the SNAP program, EPA encourages users of substitutes to apply all statements in the “Further Information” column in their use of these substitutes. In many instances, the information simply refers

to sound operating practices that have already been identified in existing industry and/or building codes or standards. Thus many of the statements, if adopted, would not require the affected user to make significant changes in existing operating practices.

D. 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/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 March 18, 1994, SNAP final rulemaking (59 FR 13044), codified at 40 CFR part 82, subpart G. A complete chronology of SNAP decisions and the appropriate citations is found at: <http://www.epa.gov/ozone/snap/chron.html>.

List of Subjects in 40 CFR Part 82

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

Dated: July 27, 2012

Sarah Dunham, Director
Office of Atmospheric Programs

APPENDIX A: SUMMARY OF ACCEPTABLE DECISIONS

Refrigeration and Air Conditioning

End-Use	Substitute	Decision	Further Information ¹
Centrifugal chillers (<i>new only</i>)	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene as a substitute for CFC-11 and HCFC-123	Acceptable ...	<p><i>Trans</i>-1-chloro-3,3,3-trifluoroprop-1-ene has an ozone depletion potential (ODP) of approximately 0.00024 to 0.00034. It has a 100-year (100-yr) global warming potential (GWP) of 4.7 to 7. Its Chemical Abstracts Service Registry Number (CAS Reg. No.) is 102687-65-0.</p> <p>The manufacturer recommends an acceptable exposure limit of 300 ppm over an 8-hour time-weighted average (8-hr TWA) for <i>trans</i>-1-chloro-3,3,3-trifluoroprop-1-ene.</p>
	HFO-1234ze as a substitute for CFC-11 and HCFC-123	Acceptable ...	<p>HFO-1234ze is also known as HFO-1234ze(E), HFC-1234ze or <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9). HFO-1234ze has a 100-yr GWP of 6.</p> <p>The American Industrial Hygiene Association (AIHA) has established a workplace environmental exposure limit (WEEL) of 800 ppm (8-hr TWA) for HFO-1234ze.</p>
Reciprocating, screw and scroll chillers (<i>new only</i>)	HFO-1234ze as a substitute for CFC-12, R-500, HCFC-22 and HCFC blends containing HCFC-22 and/or HCFC-142b	Acceptable ...	<p>HFO-1234ze is also known as HFO-1234ze(E), HFC-1234ze or <i>trans</i>-1,3,3,3-tetrafluoroprop-1-ene (CAS Reg. No. 29118-24-9). HFO-1234ze has a 100-yr GWP of 6.</p> <p>The AIHA has established a WEEL of 800 ppm (8-hr TWA) for HFO-1234ze.</p>

End-Use	Substitute	Decision	Further Information ¹
Vending machines <i>(new only)</i>	Carbon dioxide (CO ₂ or R-744) as a substitute for CFC-12, HCFC-22 and R-502	Acceptable	<p>The Occupational Safety and Health Administration (OSHA) has established a required 8 hour/day, 40 hour/week permissible exposure limit (PEL) for CO₂ of 5000 ppm. The National Institute for Occupational Safety and Health (NIOSH) has established a 15-minute recommended short-term exposure limit (STEL) of 30,000 ppm.</p> <p>EPA recommends that users follow all requirements and recommendations specified in American Society for Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standard 15.</p> <p>EPA recommends placing vending machines using CO₂ in well-ventilated spaces.</p>
Non-mechanical heat transfer <i>(new and retrofit)</i>	C7 Fluoroketone (FK-6-1-12 or Novec™ 774) as a substitute for CFC-113	Acceptable	<p>C7 Fluoroketone has a 100-year global warming potential of approximately 1. This substitute is a blend of two isomers, 3-pentanone,1,1,1,2,4,5,5,5-octafluoro-2,4-bis(trifluoromethyl) (CAS Reg. No. 813-44-5) and 3-hexanone,1,1,1,2,4,4,5,5,6,6,6-undecafluoro-2-(trifluoromethyl) (CAS Reg. No. 813-45-6).</p> <p>The manufacturer recommends an acceptable exposure limit of 225 ppm (8-hr TWA) for C7 Fluoroketone.</p>

¹ Observe recommendations in the manufacturer's MSDS and guidance for all listed refrigerants.

Foam Blowing Agents

End Use	Substitute	Decision	Further Information ¹
Rigid polyurethane and polyisocyanurate laminated boardstock	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene as a substitute for CFC-11 or HCFC-141b	Acceptable	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene has an ODP of approximately 0.00024 to 0.00034. It has a 100-yr GWP of 4.7 to 7. Its CAS Reg. No. is 102687-65-0. The manufacturer recommends an acceptable exposure limit of 300 ppm (8-hr TWA) for <i>trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene.
Rigid polyurethane appliance	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene as a substitute for CFC-11 or HCFC-141b	Acceptable	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene has an ODP of approximately 0.00024 to 0.00034. It has a 100-year GWP of 4.7 to 7. Its CAS Reg. No. is 102687-65-0. The manufacturer recommends an acceptable exposure limit of 300 ppm (8-hr TWA) for <i>trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene.
	Formacel® Z-6 as a substitute for HCFC-22, HCFC-142b, or blends thereof	Acceptable	The manufacturer recommends an acceptable exposure limit of 1000 ppm (8-hr TWA) for Formacel® Z-6.
Rigid polyurethane spray, commercial refrigeration and sandwich panels	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene as a substitute for CFC-11 or HCFC-141b	Acceptable	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene has an ODP of approximately 0.00024 to 0.00034. It has a 100-year GWP of 4.7 to 7. Its CAS Reg. No. is 102687-65-0. The manufacturer recommends an acceptable exposure limit of 300 ppm (8-hr TWA) for <i>trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene.

End Use	Substitute	Decision	Further Information ¹
Rigid polyurethane commercial refrigeration and sandwich panels	Formacel® Z-6 as a substitute for HCFC-22, HCFC-142b or blends thereof	Acceptable	The manufacturer recommends an acceptable exposure limit of 1000 ppm (8-hr TWA) for Formacel® Z-6.
Rigid polyurethane slabstock and other	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene as a substitute for CFC-11 or HCFC-141b	Acceptable	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene has an ODP of approximately 0.00024 to 0.00034. It has a 100-year GWP of 4.7 to 7. Its CAS Reg. No. is 102687-65-0. The manufacturer recommends an acceptable exposure limit of 300 ppm (8-hr TWA) for <i>trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene.
	Formacel® Z-6 as a substitute for HCFC-22, HCFC-142b or blends thereof	Acceptable	The manufacturer recommends an acceptable exposure limit of 1000 ppm (8-hr TWA) for Formacel® Z-6.
Polystyrene: extruded sheet	Formacel® Z-6 as a substitute for HCFC-22, HCFC-142b or blends thereof	Acceptable	The manufacturer recommends an acceptable exposure limit of 1000 ppm (8-hr TWA) for Formacel® Z-6.
Extruded polystyrene, boardstock and billet	Formacel® Z-6 as a substitute for HCFC-22, HCFC-142b or blends thereof	Acceptable	The manufacturer recommends an acceptable exposure limit of 1000 ppm (8-hr TWA) for Formacel® Z-6.
Integral skin polyurethane	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene as a substitute for CFC-11 or HCFC-141b	Acceptable	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene has an ODP of approximately 0.00024 to 0.00034. It has a 100-year GWP of 4.7 to 7. Its CAS Reg. No. is 102687-65-0. The manufacturer recommends an acceptable exposure limit of 300 ppm (8-hr TWA) for <i>trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene.
	Formacel® Z-6 as a substitute for HCFC-22, HCFC-142b or blends thereof	Acceptable	The manufacturer recommends an acceptable exposure limit of 1000 ppm (8-hr TWA) for Formacel® Z-6.

¹Observe recommendations in the manufacturer's MSDS and manufacturer's guidance for using all listed foam blowing agents.

Aerosols

End-Uses	Substitute	Decision	Further Information
Solvents	HFE-347pcf2 as a substitute for CFC-113, methyl chloroform, HCFC-141b and HCFC-225ca, HCFC-225cb, and blends thereof	Acceptable	<p>HFE-347pcf2 has a 100-yr GWP of 580. Its CAS Reg. No. is 406-78-0.</p> <p>The manufacturer recommends an acceptable exposure limit of 50 ppm (8-hr TWA) for this substitute. EPA recommends a ceiling limit (maximum concentration) of 150 ppm for HFE-347pcf2.</p> <p>Observe recommendations in the manufacturer's MSDS and guidance for using this substitute, particularly with respect to proper ventilation and other industrial hygiene practices.</p>
	<i>Trans</i> -1-chloro-3,3,3-trifluoroprop-1-ene as a substitute for CFC-113, methyl chloroform, HCFC-141b and HCFC-225ca, HCFC-225cb, and blends thereof	Acceptable	<p><i>Trans</i>-1-chloro-3,3,3-trifluoroprop-1-ene has an ODP of approximately 0.00024 to 0.00034. It has a 100-year GWP of 4.7 to 7. Its CAS Reg. No. is 102687-65-0.</p> <p>The manufacturer recommends an acceptable exposure limit of 300 ppm (8-hr TWA) for <i>trans</i>-1-chloro-3,3,3-trifluoroprop-1-ene.</p> <p>Observe recommendations in the manufacturer's MSDS and guidance for using this substitute.</p>

Solvent Cleaning

End-Uses	Substitute	Decision	Further Information
Electronics cleaning Precision cleaning	HFE-347pcf2 as a substitute for CFC-113, methyl chloroform, and HCFC-225ca, HCFC-225cb, and blends thereof	Acceptable ...	HFE-347pcf2 has a 100-yr GWP of 580. Its CAS Reg. No. is 406-78-0. The manufacturer recommends an acceptable exposure limit of 50 ppm (8-hr TWA) for this substitute. EPA recommends a ceiling limit (maximum concentration) of 150 ppm for HFE-347pcf2. Observe recommendations in the manufacturer's MSDS and guidance for using this substitute, particularly with respect to proper ventilation and other industrial hygiene practices.

Fire Suppression

End-Use	Substitute	Decision	Further Information ^{1,2}
Total flooding systems <i>(occupied and unoccupied areas)</i>	Cold Fire® (Surfactant Blend A) as a substitute for halon 1301.	Acceptable ...	Observe recommendations in the manufacturer's MSDS and guidance for using this substitute.

1. 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. 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, §§ 1910.160 and 1910.162.

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