

Subpart G—Significant New Alternatives Policy Program

Appendix V to Subpart G of Part 82—Substitutes Subject to Use Restrictions and Unacceptable Substitutes Listed in the December 1, 2016 Final Rule

REFRIGERANTS—ACCEPTABLE SUBJECT TO USE CONDITIONS

End-use	Substitute	Decision	Use conditions	Further information
Commercial ice machines (self-contained) (new only)	Propane (R-290)	Acceptable, subject to use conditions	As of January 3, 2017: This refrigerant may be used only in new equipment designed specifically and clearly identified for the refrigerant— <i>i.e.</i> , this refrigerant may not be used as a conversion or “retrofit” refrigerant for existing equipment	Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.106 (flammable and combustible liquids), 1910.110 (storage and handling of liquefied petroleum gases), 1910.157 (portable fire extinguishers), and 1910.1000 (toxic and hazardous substances).
			This refrigerant may be used only in self-contained commercial ice machines that meet all requirements listed in Supplement SA to UL 563. ^{1 2 5} In cases where this rule includes requirements more stringent than those in UL 563, the equipment must meet the requirements of the final rule in place of the requirements in the UL Standard	

			<p>The charge size must not exceed 150g (5.29 oz) in each refrigerant circuit of a commercial ice machine</p>	<p>Proper ventilation should be maintained at all times during</p>
			<p>As provided in clauses SA6.1.1 and SA6.1.2 of UL 563, the following markings must be attached at the locations provided and must be permanent:</p>	<p>the manufacture and storage of equipment containing hydrocarbon refrigerants through</p>
			<p>(a) “DANGER— Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing.” This marking must be provided on or near any evaporators that can be contacted by the consumer</p>	<p>adherence to good manufacturing practices as per 29 CFR 1910.106. If refrigerant levels in the air surrounding the equipment rise above one-</p>
			<p>(b) “DANGER— Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired</p>	<p>fourth of the lower flammability limit, the space should be evacuated and re-entry should occur only after the space has been properly ventilated.</p>

			Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.” This marking must be located near the machine compartment	
			(c) “CAUTION— Risk of Fire or Explosion. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting To Service This Product. All Safety Precautions Must be Followed.” This marking must be located near the machine compartment	Technicians and equipment manufacturers should wear appropriate personal protective equipment, including
			(d) “CAUTION— Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.” This marking must be provided on the exterior of the refrigeration equipment	chemical goggles and protective gloves, when handling propane. Special care should be taken to avoid contact with
			(e) “CAUTION—	the skin since propane, like many

			<p>Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used.” This marking must be provided near all exposed refrigerant tubing</p>	<p>refrigerants, can cause freeze burns on the skin.</p>
			<p>All of these markings must be in letters no less than 6.4 mm (¼ inch) high The 05equipment 05must 05have 05red 05Pantone 05Matching 05System</p>	<p>A Class B dry powder type fire extinguisher should be kept nearby.</p>
			<p>(PMS) #185 marked pipes, hoses, or other devices through which the refrigerant passes, to indicate the use of a flammable refrigerant. This color must be applied at all service ports and other parts of the system where service puncturing or other actions creating an opening from the refrigerant circuit</p>	<p>Technicians should only use spark-proof tools when working on equipment with propane. Any recovery equipment used should be designed for flammable refrigerants. Any refrigerant releases should be in a well-ventilated area, such as outside of a building. Only technicians specifically trained in handling flammable refrigerants should service equipment containing propane. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely. Room occupants should evacuate the space immediately following the accidental release of this refrigerant. If a service port is added then,</p>

			to the atmosphere might be expected and must extend a minimum of one (1) inch in both directions from such locations	commercial ice machines or equipment using propane should have service aperture fittings that differ from fittings used in equipment or containers using non-flammable refrigerant. “Differ” means that either the diameter differs by at least 1/16 inch or the thread direction is reversed (<i>i.e.</i> , right-handed 06vs. 06left-handed).
				These different fittings should be permanently affixed to the unit at the point of service and maintained until the end-of-life of the unit, and should not be accessed with an adaptor.
Very low temperature refrigeration equipment (new only)	Propane (R-290)	Acceptable, subject to use conditions	As of January 3, 2017: This refrigerant may be used only in new equipment designed specifically and clearly identified for the refrigerant— <i>i.e.</i> , this refrigerant may not be used as a conversion or “retrofit” refrigerant for existing equipment	Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.106 (flammable and combustible liquids), 1910.110 (storage and handling of liquefied petroleum gases), 1910.157 (portable fire extinguishers), and 1910.1000 (toxic and hazardous substances).
			This refrigerant may be used only in self-contained commercial ice machines that meet all requirements listed in Supplement SA to UL 563. ^{1 2 5} In cases where this rule includes requirements more stringent than those	

			in UL 563, the equipment must meet the requirements of the final rule in place of the requirements in the UL Standard	
			The charge size for the equipment must not exceed 150 grams (5.29 ounces) in each refrigerant circuit of the very low temperature refrigeration equipment	Proper ventilation should be maintained at all times during the 05manufacture 05and 05storage
			As provided in clauses SA6.1.1 and SA6.1.2 of UL 563, the following markings must be attached at the locations provided and must be permanent:	of equipment containing hydrocarbon refrigerants through adherence 06to 05good 05manufac-
			(a) "DANGER— Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. Do Not Puncture Refrigerant Tubing." This marking must be provided on or near any	turing practices as per 29 CFR 1910.106. If refrigerant levels in the air surrounding the equipment rise above one-fourth of the lower flammability

			evaporators that can be contacted by the consumer	
			(b) “DANGER— Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.” This marking must be located near the machine compartment	limit, the space should be evacuated and re-entry should occur only after the space has been properly ventilated.
			(c) “CAUTION— Risk of Fire or Explosion. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting To Service This Product. All Safety Precautions Must be Followed.” This marking must be located near the machine compartment	Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective
			(d) “CAUTION— Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local	tive gloves, when handling propane. Special care should be taken to avoid contact with the skin since propane, like many refrigerants, can cause freeze burns on the skin.

			<p>Regulations. Flammable Refrigerant Used.” This marking must be provided on the exterior of the refrigeration equipment</p>	
			<p>(e) “CAUTION— Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used.” This marking must be provided near all exposed refrigerant tubing</p>	<p>A Class B dry powder type fire extinguisher should be kept nearby. Technicians should use</p>
			<p>All of these markings must be in letters no less than 6.4 mm (¼ inch) high</p>	<p>spark-proof tools when working on equipment with pro-</p>
			<p>The equipment must have red Pantone Matching System (PMS) #185 marked pipes, hoses, or other devices through which the refrigerant passes, to indicate the use of a flammable refrigerant. This color must be</p>	<p>pane. Any recovery equipment used should be designed for flammable refrigerants. Any refrigerant releases should be in a well-ventilated area, such as outside of a building. Only technicians specifically trained in handling flammable refrigerants should service equipment containing propane. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely.</p>

			<p>applied at all service ports and other parts of the system where service puncturing or other actions creating an opening from the refrigerant circuit to the atmosphere might be expected and must extend a minimum of one (1) inch in both directions from such locations</p>	<p>Room occupants should evacuate the space immediately following the accidental release of this refrigerant.</p>
				<p>If a service port is added then, commercial ice machines or equipment using propane should have service aperture fittings that differ from fittings used in equipment or containers using non-flammable refrigerant. “Differ” means that either the diameter differs by at least 1/16 inch or the thread direction is reversed (<i>i.e.</i>, right-handed 06vs. 06left-handed).</p>
				<p>These different fittings should be permanently affixed to the unit at the point of service and maintained until the end-of-life of the unit, and should not be accessed with an adaptor.</p>
Water coolers (new only)	Propane (R-290)	Acceptable, subject to use conditions	<p>As of January 3, 2017: This refrigerant may be used only in new equipment designed specifically and clearly identified for the refrigerant—<i>i.e.</i>, this refrigerant may not be used as</p>	<p>Applicable OSHA requirements at 29 CFR part 1910 must be followed, including those at 29 CFR 1910.94 (ventilation) and 1910.106 (flammable and combustible liquids), 1910.110 (storage and handling of liquefied petroleum gases), 1910.157 (portable fire extinguishers), 05and031910.100004(toxic and hazardous substances).</p>

		<p>a conversion or “retrofit” refrigerant for existing equipment This refrigerant may be used only in water coolers that meet all requirements listed in Supplement SB to UL 399^{1 2 3} In cases where the rule includes requirements more stringent than those of the UL 399, the appliance must meet the requirements of the final rule in place of the requirements in the UL Standard</p>	
		<p>The charge size must not exceed 60 grams (2.12 ounces) per refrigerant circuit in the water cooler The equipment must have red PMS #185 marked pipes, hoses, or other devices through which the refrigerant passes, to indicate the use of a flammable refrigerant. This color must be applied at all service ports and other parts of the system where service puncturing</p>	<p>Proper ventilation should be maintained at all times during the manufacture and storage of equipment containing hydrocarbon refrigerants through adherence to good manufacturing practices as per 29 CFR 1910.106. If refrigerant levels in the air surrounding the equipment rise above one-fourth of the lower flammability limit, the space should be evacuated and re-entry should occur only after the space has been properly ventilated.</p>

			<p>or other actions creating an opening from the refrigerant circuit to the atmosphere might be expected and must extend a minimum of one (1) inch in both directions from such locations</p> <p>As provided in clauses SB6.1.2 to SB6.1.5 of UL 399, the following markings must be attached at the locations provided and must be permanent:</p> <p>(a) “DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. Do Not Use Mechanical Devices To Defrost Refrigerator. 04Do 04Not 04Puncture 04Refrigerant 04Tubing.” 04This</p>	
			<p>marking must be provided on or near any evaporators that can be contacted by the consumer</p> <p>(b) “DANGER—Risk of Fire or Explosion. Flammable Refrigerant Used. To Be Repaired</p>	<p>Technicians and equipment manufacturers should wear appropriate personal protective equipment, including chemical goggles and protective gloves, when handling propane. Special care should be taken to avoid contact with the skin since propane, like many refrigerants, can cause freeze burns on the skin.</p>

			Only By Trained Service Personnel. Do Not Puncture Refrigerant Tubing.” This marking must be located near the machine compartment	
			(c) “CAUTION— Risk of Fire or Explosion. Flammable Refrigerant Used. Consult Repair Manual/Owner's Guide Before Attempting To Service This Product. All Safety Precautions Must be Followed.” This marking must be located near the machine compartment	A Class B dry powder type fire extinguisher should be kept nearby. Technicians should only use spark-proof tools when work-
			(d) “CAUTION— Risk of Fire or Explosion. Dispose of Properly In Accordance With Federal Or Local Regulations. Flammable Refrigerant Used.” This marking must be provided on the exterior of the refrigeration equipment	ing on equipment with flammable refrigerants. Any recovery equipment used should be designed for flam-
			(e) “CAUTION—	mable refrigerants.

			<p>Risk of Fire or Explosion Due To Puncture Of Refrigerant Tubing; Follow Handling Instructions Carefully. Flammable Refrigerant Used.” This marking must be provided near all exposed refrigerant tubing</p>	<p>Any refrigerant releases should be in a well-ventilated area, such as outside of a building. Only technicians specifically trained in handling flammable refrigerants should service equipment containing propane. Technicians should gain an understanding of minimizing the risk of fire and the steps to use flammable refrigerants safely. Room occupants should evacuate the space immediately following the accidental release of this refrigerant. If a service port is added, then water coolers or equipment using propane should have service aperture fittings that differ from fittings used in equipment or containers using non-flammable refrigerant. “Differ” means that either the diameter differs by at least 1/16 inch or the thread direction is reversed (<i>i.e.</i>, right-handed vs. left-handed). 10These 10different</p>
				<p>fittings should be permanently affixed to the unit at the point of service and maintained until the end-of-life of the unit, and should not be accessed with an adaptor.</p>

¹The Director of the Federal Register approves this incorporation by reference (5 U.S.C. 552(a) and 1 CFR part 51). You may inspect a copy at U.S. EPA's Air and Radiation Docket; EPA West Building, Room 3334, 1301 Constitution Ave. NW., Washington, DC or at the National Archives and Records Administration (NARA). For questions regarding access to these standards, the telephone number of EPA's Air and Radiation Docket is 202-566-1742. For information on the availability of this material at NARA, call 202-741-6030, or go to: http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.

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

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

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

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

REFRIGERANTS—SUBSTITUTES ACCEPTABLE SUBJECT TO NARROWED USE LIMITS

End-use	Substitutes	Decision	Narrowed use limits	Further information
Centrifugal chillers (new only)	HFC-134a	Acceptable subject to narrowed use limits	Acceptable after January 1, 2024, only in military marine vessels where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: <ul style="list-style-type: none"> • Application in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and qualified and projected time for switching.
Centrifugal chillers (new only)	HFC-134a and R-404A	Acceptable subject to narrowed use limits	Acceptable after January 1, 2024, only in human-rated spacecraft and related support equipment where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: <ul style="list-style-type: none"> • Application in which the substitute is needed; • Substitutes examined and rejected;

				<ul style="list-style-type: none"> • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and qualified and projected time for switching.
Positive displacement chillers (new only)	HFC-134a	Acceptable subject to narrowed use limits	Acceptable after January 1, 2024, only in military marine vessels where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements	<p>Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of:</p> <ul style="list-style-type: none"> • Application in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or • Anticipated date other substitutes will be available and qualified and projected time for switching.
Positive displacement chillers (new only)	HFC-134a and R-404A	Acceptable subject to narrowed use limits	Acceptable after January 1, 2024, only in human-rated spacecraft and related support equipment where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements	<p>Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of:</p> <ul style="list-style-type: none"> • Application in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of

				<p>other alternatives, e.g., performance, technical or safety standards; and/or</p> <ul style="list-style-type: none"> • Anticipated date other substitutes will be available and qualified and projected time for switching.
--	--	--	--	--

REFRIGERANTS—UNACCEPTABLE SUBSTITUTES

End-use	Substitutes	Decision	Further information
Centrifugal chillers (new only)	FOR12A, FOR12B, HFC-134a, HFC-227ea, HFC-236fa, HFC-245fa, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-423A, R-424A, R-434A, R-438A, R-507A, RS-44 (2003 composition), and THR-03	Unacceptable as of January 1, 2024 except where allowed under a narrowed use limit	These refrigerants have GWPs ranging from approximately 900 to 9,810. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Centrifugal chillers (new only)	Propylene (R-1270) and R-443A	Unacceptable as of January 3, 2017	These refrigerants are highly photochemically reactive in the lower atmosphere and may deteriorate local air quality (that is, may increase ground level ozone). Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Cold storage warehouses (new only)	HFC-227ea, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-423A, R-424A, R-428A, R-434A, R-	Unacceptable as of January 1, 2023	These refrigerants have GWPs ranging from approximately 2,090 to 3,990. Other alternatives will be available for this end-use with lower overall risk to human health and

	438A, R-507A, and RS-44 (2003 composition)		the environment by the status change date.
Cold storage warehouses (new only)	Propylene (R-1270) and R-443A	Unacceptable as of January 3, 2017	These refrigerants are highly photochemically reactive in the lower atmosphere and may deteriorate local air quality (that is, may increase ground level ozone). Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Household refrigerators and freezers (new only)	FOR12A, FOR12B, HFC-134a, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-426A, R-428A, R-434A, R-437A, R-438A, R-507A, RS-24 (2002 formulation), RS-44 (2003 formulation), SP34E, and THR-03	Unacceptable as of January 1, 2021	These refrigerants have GWPs ranging from approximately 900 to 3,985. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Positive displacement chillers (new only)	FOR12A, FOR12B, HFC-134a, HFC-227ea, KDD6, R-125/134a/600a (28.1/70/1.9), R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407C, R-410A, R-410B, R-417A, R-421A, R-422B, R-422C, R-422D, R-424A, R-434A, R-437A, R-438A, R-507A, RS-44 (2003 composition), SP34E, and THR-03	Unacceptable as of January 1, 2024 except where allowed under a narrowed use limit	These refrigerants have GWPs ranging from approximately 900 to 3,985. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Positive displacement chillers (new only)	Propylene (R-1270) and R-443A	Unacceptable as of January 3, 2017	These refrigerants are highly photochemically reactive in the lower atmosphere and may deteriorate local air quality (that is, may increase

			ground level ozone). Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Residential and light commercial air conditioning and heat pumps (new only)	Propylene (R-1270) and R-443A	Unacceptable as of January 3, 2017	These refrigerants are highly photochemically reactive in the lower atmosphere and may deteriorate local air quality (that is, may increase ground level ozone). Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Residential and light commercial air conditioning—unitary split AC systems and heat pumps (retrofit only)	All refrigerants identified as flammability Class 3 in ANSI/ASHRAE Standard 34-2013 ^{1 2 3} All refrigerants meeting the criteria for flammability Class 3 in ANSI/ASHRAE Standard 34-2013. This includes, but is not limited to, refrigerant products sold under the names R-22a, 22a, Blue Sky 22a refrigerant, Coolant Express 22a, DURACOOL-22a, EC-22, Ecofreeez EF-22a, Envirosafe 22a, ES-22a, Frost 22a, HC-22a, Maxi-Fridge, MX-22a, Oz-Chill 22a, Priority Cool, and RED TEK 22a	Unacceptable as of January 3, 2017	These refrigerants are highly flammable and present a flammability risk when used in equipment designed for nonflammable refrigerants. Other alternatives are available for this end-use with lower overall risk to human health and the environment.
Retail food refrigeration (refrigerated food processing and dispensing equipment) (new only)	HFC-227ea, KDD6, R-125/290/134a/600a (55.0/1.0/42.5/1.5), R-404A, R-407A, R-407B, R-407C, R-407F, R-410A, R-410B, R-417A, R-421A, R-421B, R-422A, R-422B, R-422C, R-422D, R-424A, R-428A, R-	Unacceptable as of January 1, 2021	These refrigerants have GWPs ranging from approximately 1,770 to 3,990. Other alternatives will be available for this end-use with lower overall risk to human health and

	434A, R-437A, R-438A, R-507A, RS-44 (2003 formulation)		the environment by the status change date.
--	--	--	--

¹The Director of the Federal Register approves this incorporation by reference (5 U.S.C. 552(a) and 1 CFR part 51). You may inspect a copy at U.S. EPA's Air and Radiation Docket; EPA West Building, Room 3334, 1301 Constitution Ave. NW., Washington, DC or at the National Archives and Records Administration (NARA). For questions regarding access to this standard, the telephone number of EPA's Air and Radiation Docket is 202-566-1742. For information on the availability of this material at NARA, call 202-741-6030, or go to: http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html.

²You may obtain this material from: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 6300 Interfirst Drive, Ann Arbor, MI 48108; 1-800-527-4723 in the U.S. or Canada; http://www.techstreet.com/ashrae/ashrae_standards.html?ashrae_auth_token=.

³ANSI/ASHRAE Standard 34-2013, Designation and Safety Classification of Refrigerants, 2013.

FOAM BLOWING AGENTS—SUBSTITUTES ACCEPTABLE SUBJECT TO NARROWED USE LIMITS

End-use	Substitutes	Decision	Narrowed use limits	Further information
Rigid PU: Spray foam—high-pressure two-component	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI	Acceptable subject to narrowed use limits	Acceptable from January 1, 2020, until January 1, 2025, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2025, may be used after that date	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: <ul style="list-style-type: none"> • Process or product in which the substitute is needed; • Substitutes examined and rejected; • Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or

				<ul style="list-style-type: none"> Anticipated date other substitutes will be available and projected time for switching.
Rigid PU: Spray foam—low-pressure two-component	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC-365mfc; and Formacel TI	Acceptable subject to narrowed use limits	Acceptable from January 1, 2021, until January 1, 2025, only in military or space- and aeronautics-related applications where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements Low pressure two-component spray foam kits manufactured with these substitutes on or before January 1, 2025, for military or space- and aeronautics-related applications may be used after that date	Users are required to document and retain the results of their technical investigation of alternatives for the purpose of demonstrating compliance. Information should include descriptions of: <ul style="list-style-type: none"> Process or product in which the substitute is needed; Substitutes examined and rejected; Reason for rejection of other alternatives, e.g., performance, technical or safety standards; and/or Anticipated date other substitutes will be available and projected time for switching.

FOAM BLOWING AGENTS—UNACCEPTABLE SUBSTITUTES

End-use	Substitutes	Decision	Further information
Flexible PU	Methylene chloride	Unacceptable as of January 3, 2017	Methylene chloride is a carcinogen and may present a toxicity risk. Other alternatives are available for this end-use with lower overall risk to human health and the environment.

Rigid PU: Spray foam—one component foam sealants	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC- 365mfc; and Formacel TI	Unacceptable as of January 1, 2020 One-component foam sealant cans manufactured with these substitutes on or before January 1, 2020, may be used after that date	These foam blowing agents have GWPs ranging from higher than 730 to approximately 1,500. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Rigid PU: Spray foam—high- pressure two- component	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC- 365mfc; and Formacel TI	Unacceptable as of January 1, 2020, except where allowed under a narrowed use limit. Closed cell foam products and products containing closed cell foams manufactured with these substitutes on or before January 1, 2020, may be used after that date	These foam blowing agents have GWPs ranging from higher than 730 to approximately 1,500. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.
Rigid PU: Spray foam—low- pressure two- component	HFC-134a, HFC-245fa, and blends thereof; blends of HFC-365mfc with at least four percent HFC-245fa, and commercial blends of HFC-365mfc with seven to 13 percent HFC-227ea and the remainder HFC- 365mfc; and Formacel TI	Unacceptable as of January 1, 2021, except where allowed under a narrowed use limit Low pressure two- component spray foam kits manufactured with these substitutes on or before January 1, 2025, may be used after that date	These foam blowing agents have GWPs ranging from higher than 730 to approximately 1,500. Other alternatives will be available for this end-use with lower overall risk to human health and the environment by the status change date.

**FIRE SUPPRESSION AND EXPLOSION PROTECTION AGENTS—ACCEPTABLE SUBJECT TO USE
CONDITIONS**

End-use	Substitute	Decision	Use conditions	Further information
Streaming	2-BTP	Acceptable, subject to use conditions	As of January 3, 2017, acceptable only for use in handheld extinguishers in aircraft	This fire suppressant has a relatively low GWP of 0.23-0.26 and a short atmospheric lifetime of approximately seven days. This agent is subject to requirements contained in a Toxic Substance Control Act (TSCA) section 5(e) Consent Order and any subsequent TSCA section 5(a)(2) Significant New Use Rule

				<p>(SNUR).</p> <p>For establishments manufacturing, installing and maintaining handheld extinguishers using this agent:</p> <p>(1) Use of this agent should be used in accordance with the latest edition of NFPA Standard 10 for Portable Fire Extinguishers;</p> <p>(2) In the case that 2-BTP is inhaled, person(s) should be immediately removed and exposed to fresh air; if breathing is difficult, person(s) should seek medical attention;</p> <p>(3) 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 fresh water and move to a non-contaminated area;</p> <p>(4) Exposed person(s) should remove all contaminated clothing and footwear to avoid irritation, and medical attention should be sought if irritation develops or persists;</p> <p>(5) Although unlikely, in case of ingestion of 2-BTP, the person(s) should consult a physician immediately;</p> <p>(6) Manufacturing space should be equipped with specialized engineering controls and well ventilated with a local exhaust system and low-lying source ventilation to effectively mitigate potential occupational exposure; regular testing and monitoring of the workplace atmosphere should be conducted;</p> <p>(7) Employees responsible for chemical processing should wear the appropriate PPE, such as protective gloves, tightly sealed goggles, protective work clothing, and suitable respiratory protection in case of accidental release or insufficient ventilation;</p> <p>(8) All spills should be cleaned up immediately in accordance with good</p>
--	--	--	--	---

				<p>industrial hygiene practices; and</p> <p>(9) 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>
Total flooding	2-BTP	Acceptable, subject to use conditions	As of January 3, 2017, acceptable only for use in engine nacelles and auxiliary power units on aircraft	<p>This fire suppressant has a relatively low GWP of 0.23-0.26 and a short atmospheric lifetime of approximately seven days.</p> <p>This agent is subject to requirements contained in a TSCA section 5(e) Consent Order and any subsequent TSCA section 5(a)(2) SNUR.</p> <p>For establishments manufacturing, installing, and servicing engine nacelles and auxiliary power units on aircraft using this agent:</p> <p>(1) This agent should be used in accordance with the safety guidelines in the latest edition of the National Fire Protection Association (NFPA) 2001 Standard for Clean Agent Fire Extinguishing Systems;</p> <p>(2) In the case that 2-BTP is inhaled, person(s) should be immediately removed and exposed to fresh air; if breathing is difficult, person(s) should seek medical attention;</p> <p>(3) 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 fresh water and move to a non-contaminated area.</p> <p>(4) Exposed person(s) should remove all contaminated clothing and footwear to avoid irritation, and medical attention should be sought if irritation develops or persists;</p> <p>(5) Although unlikely, in case of ingestion of 2-BTP, the person(s) should consult a physician immediately;</p>

				<p>(6) Manufacturing space should be equipped with specialized engineering controls and well ventilated with a local exhaust system and low-lying source ventilation to effectively mitigate potential occupational exposure; regular testing and monitoring of the workplace atmosphere should be conducted;</p> <p>(7) Employees responsible for chemical processing should wear the appropriate PPE, such as protective gloves, tightly sealed goggles, protective work clothing, and suitable respiratory protection in case of accidental release or insufficient ventilation;</p> <p>(8) All spills should be cleaned up immediately in accordance with good industrial hygiene practices;</p> <p>(9) 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> <p>(10) 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; use of this agent should also conform to relevant OSHA requirements, including 29 CFR 1910, subpart L, sections 1910.160 and 1910.162.</p>
--	--	--	--	--