



**Substitutes in Non-Aerosol Solvent Cleaning Under SNAP as of October 4, 2011**  
**SNAP Information: <http://www.epa.gov/ozone/snap>**

EPA has created the Significant New Alternatives Policy (SNAP) Program under section 612 of the Clean Air Act Amendments. SNAP evaluates alternatives to ozone-depleting substances. Substitutes are reviewed on the basis of ozone depletion potential, global warming potential, toxicity, flammability, and exposure potential as described in the March 18, 1994 final SNAP rule (59 FR 13044). Lists of acceptable and unacceptable substitutes will be updated periodically in the Federal Register. The following SNAP notices and subsequent final rules are included in this list: August 26, 1994 (59 FR 44240), January 13, 1995 (60 FR 3318), June 13, 1995 (60 FR 31092), July 28, 1995 (60 FR 38729), February 8, 1996 (61 FR 4736), May 22, 1996 (61 FR 25585), September 5, 1996 (61 FR 47012), October 16, 1996 (61 FR 54030), March 10, 1997 (62 FR 10700), June 3, 1997 (62 FR 30275), February 24, 1998 (63 FR 9151), May 22, 1998 (63 FR 28251), January 26, 1999 (64 FR 3861), April 28, 1999 (64 FR 22981), June 8, 1999 (64 FR 30410), December 6, 1999 (64 FR 68039), April 11, 2000 (65 FR 19327), June 19, 2000 (65 FR 37900), December 18, 2000 (65 FR 78977), December 20, 2003 (67 FR 77927), August 13, 2003 (68 FR 50533), September 28, 2006 (71 FR 56884), May 30, 2007 (72 FR 30142), and October 4, 2011 (76 FR 61269).

**Substitutes for ELECTRONICS Cleaning under the  
Significant New Alternatives Policy (SNAP) Program as of October 4, 2011**

<b>Substitute</b>	<b>ODS Being Replaced</b>	<b>Decision</b>	<b>Conditions or Restrictions</b>	<b>Comments</b>
Aqueous cleaners	CFC-113, MCF	Acceptable	None	EPA is planning to issue effluent guidelines for this industry under the Clean Water Act.
Semi-aqueous cleaners	CFC-113, MCF	Acceptable	None	EPA is planning to issue effluent guidelines for this industry under the Clean Water Act.
Straight organic solvent cleaning (with terpenes, C5-C20 petroleum hydrocarbons, oxygenated organic solvents such as ketones, esters, ethers, alcohols, etc.)	CFC-113, MCF	Acceptable	None	OSHA standards must be met, if applicable.
Trichloroethylene, perchloroethylene, methylene chloride	CFC-113, MCF	Acceptable	None	OSHA and RCRA standards must be met. EPA issued Maximum Achievable Control Technology requirements under the Clean Air Act for vapor degreasing in November 1994.
No-clean alternatives	CFC-113, MCF	Acceptable	None	Substitutes found acceptable include low solids fluxes and inert gas soldering.
Supercritical fluids, plasma cleaning, UV / Ozone cleaning	CFC-113, MCF	Acceptable	None	OSHA standards for ozone must be met.

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Volatile methyl siloxanes	CFC-113, MCF	Acceptable	None	Approval is granted for the whole class of compounds.
Trans-1,2-dichloroethylene	CFC-113, MCF	Acceptable	None	The OSHA set exposure limit is 200 ppm.
Hydrofluorether (HFE) 7100: methoxynonafluorobutane, iso and normal (C4F9OCH3)	CFC-113, MCF, HCFC-141b, HCFC-22	Acceptable	None	None
HFE-7200 (C5F9OCH3)	CFC-113, MCF	Acceptable	None	The Agency expects that any exposures will not exceed any acceptable exposure limits set by any voluntary consensus standards organization, including the American Conference of Governmental Industrial Hygienists= (ACGIH) threshold limit values (TLVs) or the American Industrial Hygiene Association=s (AIHA) workplace environmental exposure limits (WEELs).
Heptafluorocyclopentane	CFC-113, MCF, HCFC-141b	Acceptable	None	EPA expects users to adhere to an exposure limit of 123 ppm over an eight-hour time-weighted average, with a ceiling of 500 ppm.
HFC-365mfc	CFC-113, MCF, HCFC-141b	Acceptable	None	None
HFE-7000	CFC-113, MCF	Acceptable	None	EPA expects that the workplace environmental exposure will not exceed the workplace exposure limit of 75 ppm and that users will observe the manufacturer=s recommendations in MSDSs.
The Mini-Max Cleaner	CFC-113, MCF, HCFCs	Acceptable	None	None

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n-propyl bromide	CFC-113, MCF	Acceptable	None	<p>EPA recommends the use of personal protective equipment, including chemical goggles, flexible laminate protective gloves and chemical-resistant clothing.</p> <p>EPA expects that all users of nPB would comply with any final Permissible Exposure Limit that the Occupational Safety and Health Administration issues in the future under 42 U.S.C. 7610(a).</p> <p>nPB, also known as 1-bromopropane, is Number 106-94-5 in the Chemical Abstracts Service (CAS) Registry.</p>
Perfluorobutyl iodide (PFBI)	CFC-113, MCF, HCFC-225ca, HCFC-225cb and blends thereof	Acceptable	None	<p>PFBI has an ODP of less than 0.005 and a 100-year GWP of less than 5. Its CAS Reg. No. is 423-39-2.</p> <p>EPA recommends an acceptable exposure limit of 375ppm (8-hour time-weighted average) for PFBI.</p> <p>Observe recommendations in the manufacturer's MSDS and guidance for using this substitute, particularly with respect to disposal. Prevent the solvent from entering waterways.</p> <p>PFBI is currently defined as a volatile organic compound (VOC) under CAA regulations (see 40 CFR 51.100(s)).</p>
Perfluoropolyethers	CFC-113, MCF	Acceptable subject to narrowed use limits	Acceptable for high-performance, precision-engineered applications only where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	PFPEs have similar global warming profiles to the PFCs, and the SNAP decision on PFPEs parallels that for PFCs.
Monochlorotoluenes and benzotrifluorides	CFC-113, MCF	Acceptable subject to use conditions	Subject to a 50 ppm workplace standard for monochlorotoluenes and a 100 ppm standard for benzotrifluoride.	The workplace standard for monochlorotoluenes is based on an OSHA PEL of 50 ppm for orthochlorotoluene. The workplace standard for benzotrifluorides is based on the company-set acceptable exposure limit.
HFC-4310mee	CFC-113, MCF, HCFC-141b	Acceptable subject to use conditions	Subject to a 200 ppm time-weighted average workplace exposure standard and 400 ppm workplace exposure ceiling.	None

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HCFC-225ca / cb	CFC-113, MCF	Acceptable subject to use conditions	Subject to the company-set exposure limit of 25 ppm for the -ca isomer.	HCFC-225ca/cb is offered as an isomeric blend. The company-set workplace standard for the ca-isomer is 25 ppm and for the cb isomer 250ppm. Those of the less toxic cb-isomer suggests that the 25 ppm standard for the blend can be readily met.
Dibromomethane	CFC-113, MCF	Unacceptable	N/A	High ODP; other alternatives exist.
HCFC 141b and its blends	CFC-113, MCF	Unacceptable	N/A	High ODP; other alternatives exist.
Chlorobromomethane	CFC-113, MCF, HCFC-141b	Unacceptable	N/A	High ODP; other alternatives exist.

**Substitutes for METALS Cleaning under the  
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<b>Substitute</b>	<b>ODS Being Replaced</b>	<b>Decision</b>	<b>Conditions or Restrictions</b>	<b>Comments</b>
Aqueous cleaners	CFC-113, MCF	Acceptable	None	EPA is planning to issue effluent guidelines for this industry under the Clean Water Act.
Semi-aqueous cleaners	CFC-113, MCF	Acceptable	None	EPA is planning to issue effluent guidelines for this industry under the Clean Water Act.
Straight organic solvent cleaning (with terpenes, C5-C20 petroleum hydrocarbons, oxygenated organic solvents such as ketones, esters, ethers, alcohols, etc.)	CFC-113, MCF	Acceptable	None	OSHA standards must be met, if applicable.
Trichloroethylene, perchloroethylene, methylene chloride	CFC-113, MCF	Acceptable	None	OSHA and RCRA standards must be met. EPA issued Maximum Achievable Control Technology requirements under the Clean Air Act for vapor degreasing.
Vanishing oils	CFC-113, MCF	Acceptable	None	Depending on geographic region, may be subject to VOC controls.
Supercritical fluids	CFC-113, MCF	Acceptable	None	None
Volatile methyl siloxanes	CFC-113, MCF	Acceptable	None	Approval is granted for the whole class of compounds.
Trans-1,2-dichloroethylene	CFC-113, MCF	Acceptable	None	The OSHA set exposure limit is 200 ppm.
HFC-4310mee	CFC-113, MCF HCFC-141b	Acceptable	None	Company-set time-weighted average workplace exposure standard of 200 ppm, and a workplace exposure ceiling of 400 ppm.
Hydrofluorether (HFE) 7100: methoxynonafluorobutane, iso and normal (C4F9OCH3)	CFC-113, MCF, HCFC-141b, HCFC-22	Acceptable	None	None
HFE-7200 (C5F9OCH3)	CFC-113, MCF	Acceptable	None	The Agency expects that any exposures will not exceed any acceptable exposure limits set by any voluntary consensus standards organization, including the American Conference of Governmental Industrial Hygienists= (ACGIH) threshold limit values (TLVs) or the American Industrial Hygiene Association=s (AIHA) workplace environmental exposure limits (WEELs).

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<b>Substitute</b>	<b>ODS Being Replaced</b>	<b>Decision</b>	<b>Conditions or Restrictions</b>	<b>Comments</b>
Heptafluorocyclopentane	CFC-113, MCF, HCFC-141b	Acceptable	None	EPA expects users to adhere to an exposure limit of 123 ppm over an eight-hour time-weighted average, with a ceiling of 500 ppm.
HFC-365mfc	CFC-113, MCF, HCFC-141b	Acceptable	None	None
HCFC-225ca and HCFC-225cb	CFC-113, MCF	Acceptable	None	EPA recommends observing the manufacturer=s recommended exposure guidelines of 50 ppm for the -ca isomer, 400 ppm for the -cb isomer, and 100 ppm for the commercial mixture of HCFC-225ca/cb.  EPA encourages users to consider other alternatives that do not have an ozone depletion potential.
The Mini-Max Cleaner	CFC-113, MCF, HCFCs	Acceptable	None	None
n-propyl bromide	CFC-113, MCF	Acceptable	None	EPA recommends the use of personal protective equipment, including chemical goggles, flexible laminate protective gloves and chemical-resistant clothing.  EPA expects that all users of nPB would comply with any final Permissible Exposure Limit that the Occupational Safety and Health Administration issues in the future under 42 U.S.C. 7610(a).  nPB, also known as 1-bromopropane, is Number 106-94-5 in the Chemical Abstracts Service (CAS) Registry.
Perfluorobutyl iodide (PFBI)	CFC-113, MCF, HCFC-225ca, HCFC-225cb and blends thereof	Acceptable	None	PFBI has an ODP of less than 0.005 and a 100-year GWP of less than 5. Its CAS Reg. No. is 423-39-2.  EPA recommends an acceptable exposure limit of 375ppm (8-hour time-weighted average) for PFBI.  Observe recommendations in the manufacturer's MSDS and guidance for using this substitute, particularly with respect to disposal. Prevent the solvent from entering waterways.  PFBI is currently defined as a volatile organic compound (VOC) under CAA regulations (see 40 CFR 51.100(s)).
Monochlorotoluenes and benzotrifluorides	CFC-113, MCF	Acceptable subject to use conditions	Subject to a 50 ppm workplace standard for monochlorotoluenes and a 100 ppm standard for benzotrifluoride.	The workplace standard for monochlorotoluenes is based on an OSHA PEL of 50 ppm for orthochlorotoluene. The workplace standard for benzotrifluorides is based on the company-set acceptable exposure limit.

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<b>Substitute</b>	<b>ODS Being Replaced</b>	<b>Decision</b>	<b>Conditions or Restrictions</b>	<b>Comments</b>
Dibromomethane	CFC-113, MCF	Unacceptable	N/A	High ODP; other alternatives exist.
HCFC 141b and its blends	CFC-113, MCF	Unacceptable	N/A	High ODP; other alternatives exist.
Chlorobromomethane	CFC-113, MCF, HCFC-141b	Unacceptable	N/A	High ODP; other alternatives exist.

**Substitutes for PRECISION Cleaning under the  
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<b>Substitute</b>	<b>ODS Being Replaced</b>	<b>Decision</b>	<b>Conditions or Restrictions</b>	<b>Comments</b>
Aqueous cleaners	CFC-113, MCF	Acceptable	None	EPA is planning to issue effluent guidelines for this industry under the Clean Water Act.
Semi-aqueous cleaners	CFC-113, MCF	Acceptable	None	EPA is planning to issue effluent guidelines for this industry under the Clean Water Act.
Straight organic solvent cleaning (with terpenes, C5-C20 petroleum hydrocarbons, oxygenated organic solvents such as ketones, esters, ethers, alcohols, etc.)	CFC-113, MCF	Acceptable	None	OSHA standards must be met, if applicable.
Trichloroethylene, perchloroethylene, methylene chloride	CFC-113, MCF	Acceptable	None	OSHA and RCRA standards must be met. EPA issued Maximum Achievable Control Technology requirements under the Clean Air Act for vapor degreasing in November 1994.
Supercritical fluids, plasma cleaning, UV/Ozone cleaning	CFC-113, MCF	Acceptable	None	OSHA standards for ozone must be met.
HCFC-123	CFC-113, MCF	Acceptable	None	Has an AEL of 30ppm.
Trans-1,2-dichloroethylene	CFC-113, MCF	Acceptable	None	The OSHA set exposure limit is 200 ppm.
Hydrofluorether (HFE) 7100: methoxynonafluorobutane, iso and normal (C4F9OCH3)	CFC-113, MCF, HCFC 141b	Acceptable	None	None
HFE-7200 (C5F9OCH3)	CFC-113, MCF	Acceptable	None	The Agency expects that any exposures will not exceed any acceptable exposure limits set by any voluntary consensus standards organization, including the American Conference of Governmental Industrial Hygienists= (ACGIH) threshold limit values (TLVs) or the American Industrial Hygiene Association=s (AIHA) workplace environmental exposure limits (WEELs).
Heptafluorocyclopentane	CFC-113, MCF, HCFC-141b	Acceptable	None	EPA expects users to adhere to an exposure limit of 123 ppm over an eight-hour time-weighted average, with a ceiling of 500 ppm.

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HFC-365mfc	CFC-113, MCF, HCFC-141b	Acceptable	None	None
HFE-7000	CFC-113, MCF	Acceptable	None	EPA expects that the workplace environmental exposure will not exceed the workplace exposure limit of 75 ppm and that users will observe the manufacturer=s recommendations in MSDSs.
The Mini-Max Cleaner	CFC-113, MCF, HCFCs	Acceptable	None	None
n-propyl bromide	CFC-113, MCF	Acceptable	None	<p>EPA recommends the use of personal protective equipment, including chemical goggles, flexible laminate protective gloves and chemical-resistant clothing.</p> <p>EPA expects that all users of nPB would comply with any final Permissible Exposure Limit that the Occupational Safety and Health Administration issues in the future under 42 U.S.C. 7610(a).</p> <p>nPB, also known as 1-bromopropane, is Number 106-94-5 in the Chemical Abstracts Service (CAS) Registry.</p>
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HFC-4310mee	CFC-113, MCF, HCFC-141b	Acceptable subject to use conditions	Subject to a 200 ppm time-weighted average workplace exposure standard and 400 ppm workplace exposure ceiling.	None
HCFC-225ca / cb	CFC-113, MCF	Acceptable subject to use conditions	Subject to the company-set exposure limit of 25 ppm for the -ca isomer.	HCFC-225ca/cb is offered as an isomeric blend. The company-set workplace standard for the ca-isomer is 25 ppm and for the cb isomer 250ppm. Those of the less toxic cb-isomer suggests that the 25 ppm standard for the blend can be readily met.
Perfluoropolyethers	CFC-113, MCF	Acceptable subject to narrowed use limits	Acceptable for high-performance, precision-engineered applications only where reasonable efforts have been made to ascertain that other alternatives are not technically feasible due to performance or safety requirements.	PFPEs have similar global warming profiles to the PFCs, and the SNAP decision on PFPEs parallels that for PFCs.
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Chlorobromomethane	CFC-113, MCF, HCFC-141b	Unacceptable	N/A	High ODP; other alternatives exist.