ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 9 & 82

Protection of Stratospheric Ozone

AGENCY: Environmental Protection Agency

ACTION: Notice of Acceptability

SUMMARY: This notice expands the list of acceptable substitutes for ozone depleting substances (ODSs) under the U.S. Environmental Protection Agency's (EPA) Significant New Alternatives Policy (SNAP) program. SNAP implements section 612 of the amended Clean Air Act of 1990 whereby EPA is required to evaluate substitutes for the ODSs, and regulate the use of substitutes where other alternatives exist that reduce overall risk to human health and the environment. Through these evaluations, SNAP generates lists of acceptable and unacceptable substitutes for each of the major industrial use sectors.

On March 18, 1994, EPA promulgated its plan for administering the SNAP program, and issued decisions on the acceptability and unacceptability of a number of substitutes (59 FR 13044). In today's Notice, EPA is issuing decisions on the acceptability of certain substitutes not previously reviewed by the Agency. The intended effect of this action is to expedite movement away from ozone depleting compounds. To arrive at determinations on the acceptability of substitutes, the Agency completed a cross-media sector end-use screening assessment of risks to human health and the environment.

As described in the final rule for the SNAP program (59 FR 13044), EPA does not believe that rulemaking procedures are required to list alternatives as acceptable with no limitations. Such listings do not impose any sanction, nor do they remove any prior license to use a substance. Consequently, EPA is adding substances to the list of acceptable alternatives without first requesting comment on new listings.

EPA does, however, believe that notice-and-comment rulemaking is required to place any substance on the list of prohibited substitutes, to list a substance as acceptable only under certain conditions, to list substances as acceptable only for certain uses, or to remove asubstance from either the list of prohibited or acceptable substitutes. Updates to these lists are published as separate notices of rulemaking in the Federal Register.

EFFECTIVE DATE: **[FR publication date]**.

ADDRESSES: Information relevant to this notice is contained in Air Docket A-91-42, Central Docket Section, South Conference Room 4, U.S. Environmental Agency, 401 M Street, S.W., Washington, D.C. 20460. Telephone: (202) 260-7549. The docket may be inspected between 8:00 a.m. and 4:00 p.m. weekdays. As provided in 40 CFR part 2, a

reasonable fee may be charged for photocopying.

FOR FURTHER INFORMATION CONTACT: Sally Rand at (202) 233-9739 or fax (202) 233-9577, U.S. EPA, Stratospheric Protection Division, 401 M Street, S.W., 6205-J, Washington, D.C. 20460.

SUPPLEMENTARY INFORMATION:

I. Overview of This Action

This action is divided into six sections, including this overview:

II. Section 612 Program

A. Statutory Requirements

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

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

. Listing of Unacceptable / Acceptable Substitutes--Section 612(c) also requires EPA to publish a list of the substitutes unacceptable for specific uses. EPA must publish a corresponding list of acceptable alternatives for specific uses.

. 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 6 months.

. 90-day Notification--Section 612(e) requires 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.

. 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.

. 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. Regulatory History

On March 18, 1994, EPA published the Final Rulemaking (FRM) (59 FR 13044) which described the process for administering the SNAP program and issued EPA's first acceptability lists for substitutes in the major industrial use sectors. These sectors include: refrigeration and air conditioning; foam blowing; solvent cleaning; fire suppres-

sion and explosion protection; sterilants; aerosols; adhesives, coatings and inks; and tobacco expansion. These sectors compose the principal industrial sectors that historically consume the largest volumes of ozone-depleting compounds.

The Agency defines a "substitute" as any chemical, product substitute, or alternative manufacturing process, whether existing or new, that could replace a class I or class II substance. Anyone who produces a substitute must provide the Agency with health and safety studies on the substitute at least 90 days before introducing it into interstate commerce for significant new use as an alternative. This requirement applies to substitute manufacturers, but may include importers, formulators or end-users, when they are responsible for introducing a substitute into commerce.

III. Listing of Acceptable Substitutes

This section presents EPA's most recent acceptable listing decisions for class I substitutes in the following industrial sectors: refrigerants and air conditioning, foam blowing, solvent cleaning, fire suppression and explosion protection; sterilants; aerosols; adhesives, coatings and inks. These decisions represent substitutes not previously reviewed in the final rulemaking for SNAP (59 FR 13044; March 18, 1994) and, consequently, add to the lists of acceptable substitutes under SNAP. For copies of the full list, contact the EPA Stratospheric Protection Hotline at the number listed in Section V of this notice.

Parts A through H below present a detailed discussion of the substitute listing determinations by major use sector. Tables summarizing listing decisions in this notice are in Appendix A. The comments contained in Appendix A provide additional information on a substitute, but like the listings themselves, are not regulatory in nature, and thus they are not mandatory for use of a substitute. Nor should the comments be considered comprehensive with respect to other legal obligations pertaining to the use of the substitute. However, EPA encourages users of acceptable substitutes to apply all comments to their use of thesesubstitutes. In many instances, the comments simply allude to sound operating practices that have already been identified in existing industry and/or building-code standards. Thus, many of the comments, if adopted, would not

require significant changes in existing operating practices for the affected industry.

As described in the final rule for the SNAP program, EPA does not believe that rulemaking procedures are required to list alternatives as acceptable with no limitations. Such listings do not impose any sanction, nor do they remove any prior license to use a substitute. Consequently, EPA is adding substances to the list of acceptable alternatives without first requesting comment on new listings.

EPA, however, does believe that notice-and-comment rulemaking is required to place any alternative on the list of prohibited substitutes, to list a substitute as acceptable only under use restrictions, or to remove a substitute from either the list of prohibited or acceptable substitutes. Updates to these lists are published as separate notices of rulemaking in the Federal Register.

D. Refrigeration and Air Conditioning

1. Overview

The refrigeration and air conditioning sector includes all uses of class I and class II substances to produce cooling, including mechanical and non-mechanical refrigeration, air conditioning, and heat transfer. Please refer to the final SNAP rule (59 FR 13044) for a more detailed description of this sector.

The refrigeration and air conditioning sector is divided into the following end-uses:

- commercial comfort air conditioning;
- industrial process refrigeration systems;
- industrial process air conditioning;
- ice skating rinks;
- uranium isotope separation processing;
- cold storage warehouses;
- refrigerated transport;
- retail food refrigeration;
- vending machines;
- water coolers;

- commercial ice machines;
- household refrigerators;
- household freezers;
- residential dehumidifiers;
- motor vehicle air conditioning;
- residential air conditioning and heat pumps;
- non-mechanical heat transfer;

  and
- very low temperature refrigeration.

In addition, each end-use is divided into retrofit and new equipment applications. EPA has not necessarily reviewed substitutes in every end-use for this Notice.

EPA has modified the list of end-uses for this sector for this SNAP update. First, EPA has changed the name of the heat transfer end-use to non-mechanical heat transfer. This change is intended to avoid confusion between systems that move heat from a cool area to a warm one (mechanical refrigeration) and systems that simply aid the movement of heat away from warm areas (non-mechanical heat transfer). The second change is that EPA added a new end-use, very low temperature refrigeration. Substitutes for this end-use have been reviewed since the final rule, and therefore have been added for this SNAP update. Finally, EPA has also reviewed substitutes for CFC-13, R-13B1, and R-503 industrial process refrigeration. Please refer to the final SNAP rule (59 FR 13044) for a detailed description of end-uses other than these three. EPA may continue to add other end-uses in future SNAP updates.

a. Non-mechanical Heat Transfer

As discussed above, this end-use includes all cooling systems that rely on a fluid to remove heat from a heat source to a cooler area, rather than relying on mechanical refrigeration to move heat from a cool area to a warm one. Generally, there are two types of systems: systems with fluid pumps, referred to as recirculating coolers, and those that rely on natural convection currents, known as thermosyphons.

b. Very Low Temperature Refrigeration

Medical freezers, freeze-dryers, and other small appliances require extremely reliable refrigeration cycles. These systems must meet stringent technical standards that do not normally apply to refrigeration systems. They usually have very small charges. Because they operate at very high vapor pressures, and because performance is critically affected by any charge loss, standard maintenance for these systems tends to reduce leakage to a level considerably below that for other types of refrigeration and air conditioning equipment.

c. CFC-13, R-13B1, and R-503 Industrial Process Refrigeration

This end-use differs from other types of industrial refrigeration only in the extremely low temperature regimes that are required. Although some substitutes may work in both these extremely low temperatures and in systems designed to use R-502, they are acceptable only for this end-use because of global warming and atmospheric lifetime concerns. These concerns are discussed more fully below.

2. Corrections from the March 18, 1994 FRM

In the FRM, the components of two refrigerants, R-404A and R-507, were inadvertently reversed. R-507 consists of HFC-125 and HFC-143a, and R-404A consists of HFC-125, HFC-143a, and HFC-134a. These blends were listed as acceptable for the same end-uses, so the reversal had no effect on the acceptable status of either refrigerant.

Also in the FRM, EPA listed HFC-134a as acceptable in several CFC-12 end-uses. In the descriptive text, EPA wrote "while HFC-134a is compatible with most existing refrigeration and air conditioning equipment parts, it is not compatible with mineral oils currently used in such systems. An ester-based lubricant should be used rather than mineral oils." EPA's intention was to alert users to the need to use lubricants other than current mineral oils, rather than to recommend a particular type of new oil. While it remains true that mineral oils are incompatible with HFC-134a, it is not true that polyol ester oils are the only replacement. Polyalkylene glycol oils are also available, and are in fact the predominant choice of the automobile manufacturers. Therefore, the portion of each listing for HFC-134a should have read "An appropriate ester-based, polyalkylene glycol-based, or other type of lubricant should be used." In addition, specifically in the

Motor Vehicle AirConditioning end-use, the listing for HFC-134a should have included the recommendation to consult the original equipment manufacturer or the retrofit kit manufacturer for further information. For clarity, these changes have been incorporated into the listing for HFC-134a in Motor Vehicle Air Conditioning in the NPRM.

3. Substitutes for Refrigerants

Substitutes fall into eight broad categories. Seven of these categories are chemical substitutes used in the same vapor compression cycle as the ozone-depleting substances being replaced. They include hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), hydrocarbons, refrigerant blends, ammonia, perfluorocarbons (PFCs), and chlorine systems. The eighth category includes alternative technologies that generally do not rely on vapor compression cycles. Please refer to the final SNAP rule (59 FR 13044) for more discussion of these broad categories.

4. Listing Decisions

a. Acceptable Substitutes

These determinations are based on data submitted to EPA and on the risk screen described in the draft background document entitled "Risk Screen on the Use of Substitutes for Class I Ozone-Depleting Substances: Refrigerants". In accordance with the guiding principles for SNAP, substitutes were compared both to the substance they replace and to each other.

EPA believes the use of all acceptable substitutes presents lower overall risk than the continued use of an ozone-depleting substance. Not all substitutes will necessarily be appropriate choices for all systems within an end-use. Engineering decisions must take intoaccount factors such as operating temperatures and pressures, ambient conditions, and age of equipment, especially during retrofits. For example, substitutes listed under industrial process refrigeration may be listed as acceptable for retrofits for both CFC-12 and R-502 systems. However, these substances exhibit significantly different thermodynamic characteristics, and a substitute for one may not be appropriate for use as a substitute for the other. EPA believes such decisions are most appropriately made by the equipment owner, manager, or contractor.

Users of HCFCs should be aware that an acceptability determination shall not be construed to release any user from compliance with all other regulations pertaining to class II substances. These include: (a) the prohibition against venting during servicing under section 608, which was effective July 1, 1992; (b) recycling requirements under section 608, which were effective July 13, 1993; (c) section 609 regulations regarding MVACS which were effective August 13, 1992; and (d) the revised production phaseout of class II substances under section 606, which was published on December 10, 1993. In addition, users of refrigerants that do not contain chlorine should be aware that an acceptability determination shall not be construed to release any user from compliance with the venting prohibition under section 608(c)(2), which takes effect November 15, 1995, at the latest.

Substitutes are listed as acceptable by end-use. These substitutes have only been found acceptable for use in the specific end-uses for which they have been reviewed, as described in this section. Users of blends should be aware that EPA has evaluated and found acceptable in each case only the specific percentage composition submitted for review; no others have been evaluated. EPA strongly recommends that users of alternative refrigerantsadhere to the provisions of ASHRAE Standard 15 - Safety Code for Mechanical Refrigeration when applicable. ASHRAE Standard 34 - Number Designation and Safety Classification of Refrigerants is a useful reference on refrigerant numerical designations. Users are also strongly encouraged to contain, recycle, and reclaim all refrigerants.

(1) R-500 Centrifugal Chillers, Retrofit

(a) R-406A

R-406A, which consists of HCFC-22, HCFC-142b, and isobutane,is acceptable as a substitute for R-500 in retrofitted centrifugal chillers. Because HCFC-22 and HCFC-142b contribute to ozone depletion, this blend is considered a transitional alternative. Regulations regarding recycling and reclamation issued under section 608 of the Clean Air Act apply to this blend. HCFC-142b has one of the highest ODPs among the HCFCs. The GWPs of HCFC-22 and HCFC-142b are somewhat high. Although HCFC-142b is

flammable, the blend is not. After significant leakage, however, this blend may become weakly flammable.

(2) CFC-11, CFC-12, and R-502 Industrial Process Refrigeration, Retrofit

Please note that different temperature regimes may affect the applicability of substitutes within this end-use.

(a) HCFC-123

HCFC-123 is acceptable as a substitutes for CFC-11, CFC-12, and R-502 in retrofitted industrial process refrigeration. Because HCFC-123 contributes to ozone depletion, it is considered a transitional alternative. Since it poses much lower ozone-depleting risk than continued use of CFCs, EPA has determined that its use isacceptable for certain end-uses. In addition, HCFC-123's GWP and atmospheric lifetime are significantly lower than almost all other alternatives. HCFC-123 is not flammable. EPA strongly recommends that users of HCFC-123 adhere to any requirements provided in ASHRAE Standards 15 and 34. Worker-monitoring studies conducted by EPA demonstrate that in office building equipment rooms, HCFC-123's 8-hour time-weighted average concentration can be maintained at or under 1 ppm (less than the industry-established AEL of 30 ppm), provided that such standards are followed. HCFC-123 is acceptable for use in commercial building chillers and should pose no hazard in industrial uses.

(b) R-406A

R-406A, which consists of HCFC-22, HCFC-142b, and isobutane, is acceptable as a substitute for CFC-11, CFC-12, and R-502 in retrofitted industrial process refrigeration. See the discussion on R-406A under retrofitted R-500 centrifugal chillers.

(c) R-407A and R-407B

R-407A and R-407B, which consist of HFC-134a, HFC-32, and HFC-125, are acceptable as substitutes for CFC-11, CFC-12, and R-502 in retrofitted industrial process refrigeration. None of the components contribute to ozone depletion. However, HFC-125 has a very high GWP and HFC-134a has a moderate GWP. EPA strongly encourages recycling and reclamation of this blend in order to reduce its direct global

warming impact. Although HFC-143a is flammable, the blend is not. Leak testing has demonstrated that its composition never becomes flammable.

(d) HCFC Blend Epsilon

HCFC Blend Epsilon, which consists of HCFC-22, HFC-143a, and HFC-125, is acceptable as a substitute for CFC-11, CFC-12, and R-502 in retrofitted industrial process refrigeration. Because HCFC-22 contributes to ozone depletion, this blend is considered a transitional alternative. Regulations regarding recycling and reclamation issued under section 608 of the Clean Air Act apply to this blend. HFC-125 and HFC-143a have very high GWPs, and the GWP of HFC-22 is somewhat high. Although HFC-143a is flammable, the blend is not. Leak testing has demonstrated that its composition never becomes flammable.

(3) CFC-11, CFC-12, and R-502 Industrial Process Refrigeration, New

Please note that different temperature regimes may affect the applicability of substitutes within this end-use.

(a) HCFC-123

HCFC-123 is acceptable as a substitute for CFC-11, CFC-12, and R-502 in new industrial process refrigeration. Because HCFC-123 contributes to ozone depletion, it is considered a transitional alternative. Since it poses much lower ozone-depleting risk than continued use of CFCs, EPA has determined that its use is acceptable for certain end-uses. In addition, HCFC-123's GWP and atmospheric lifetime are significantly lower than almost all other alternatives. HCFC-123 is not flammable. EPA strongly recommends that users of HCFC-123 adhere to any requirements provided in ASHRAE Standards 15 and 34. Worker-monitoring studies conducted by EPA demonstrate that in office building equipment rooms, HCFC-123's 8-hour time-weighted average concentration can be maintained at or under 1 ppm (less than the industry-established AEL of 30 ppm), provided that suchstandards are followed. HCFC-123 is acceptable for use in commercial building chillers and should pose no hazard in industrial uses.

(b) R-407A and R-407B

R-407A and R-407B, which consist of HFC-134a, HFC-32, and HFC-125, are acceptable as substitutes for CFC-11, CFC-12, and R-502 in new industrial process refrigeration. See the discussion on these blends under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(4) CFC-13, R-13B1, and R-503 Industrial Process Refrigeration, Retrofit and New

This type of refrigeration requires temperatures well below those achieved with R-502 or HCFC-22. A limited number of substitutes have been identified that are capable of meeting technical requirements. These substitutes all contain components with extremely high GWPS, and EPA is concerned about their potential contribution to global warming. However, under SNAP, EPA intends to only find those substitutes unacceptable that clearly present greater overall risk. Given this framework, EPA finds these high-GWP substitutes acceptable. At the same time, EPA strongly urges industry to develop new alternatives for this end-use that do not contain substances with such high GWPs and long lifetimes.

(a) HFC-23

HFC-23 is acceptable as a substitute for CFC-13, R-13B1, and R-503 in retrofitted and new industrial process refrigeration. HFC-23 has an extremely high 100-year GWP of 9000 relative to CO_2 and a lifetime of 280 years. Its GWP is the highest among the HFCs, and its lifetime is exceeded only by the PFCs. EPA believes HFC-23 could contributesignificantly to global warming. In addition, the long lifetime of HFC-23 means any global warming or other effects would be essentially irreversible. While the current rule issued under section 608 of the CAA does not require recycling and recovery of HFC-23, or leak repair for systems using HFC-23, EPA strongly encourages users to anticipate future rulemakings with voluntary compliance. In particular, EPA urges users to reduce leakage and recover and recycle HFC-23 during equipment servicing and upon the retirement of equipment. HFC-23 is nonflammable and does not deplete stratospheric ozone.

(b) R-403B

R-403B, which consists of HCFC-22, R-218, and propane, is acceptable as a

substitute for CFC-13, R-13B1, and R-503 in retrofitted and new industrial process refrigeration. Because HCFC-22 contributes to ozone depletion, this blend is considered a transitional alternative. Regulations regarding recycling and reclamation issued under section 608 of the Clean Air Act apply to this blend. R-218, or perfluoropropane, is an extremely long-lived substance with an extremely high GWP. EPA believes this blend could contribute significantly to global warming. In addition, the long lifetime of R-218 means any global warming or other effects would be essentially irreversible. R-403B is only acceptable as a substitute for this end-use. The GWP of HCFC-22 is also somewhat high. Although propane is flammable, the blend is not. Leak testing has demonstrated that the blend's composition never becomes flammable. In a proposed rulemaking soon to be issued, EPA intends to propose R-403B unacceptable as a substitute for R-502 in all end-uses because other substitutes have been identified which do not exhibit such extreme GWPs or lifetimes.

(c) PFC Blend Alpha

PFC Blend Alpha, which contains HFC-23 and R-116, is acceptable as a substitute for CFC-13, R-13B1, and R-503 in retrofitted and new industrial process refrigeration. Both components of this blend exhibit extremely high GWPs and long lifetimes. HFC-23 has a GWP of 9,000 and a lifetime of 280 years, and R-116, perfluoroethane, has a GWP of 9,000 and a lifetime of 10,000 years. EPA believes this blend could significantly contribute to global warming if allowed to escape refrigeration systems. In addition, the long lifetimes of R-116 and HFC-23 mean any global warming or other effects would be essentially irreversible. While the current rule issued under section 608 of the CAA does not require recycling and recovery of this blend, or leak repair for systems using it, EPA strongly encourages users to anticipate future rulemakings with voluntary compliance. In particular, EPA urges users to reduce leakage and recover and recycle this blend during equipment servicing and upon the retirement of equipment. This blend is nonflammable and does not deplete ozone.

(5) CFC-12 and R-502 Ice Skating Rinks, Retrofit and New

Please note that different temperature regimes may affect the applicability of sub-

stitutes within this end-use.

(a) R-407A and R-407B

R-407A and R-407B, which consist of HFC-134a, HFC-32, and HFC-125, are acceptable as substitutes for CFC-12 and R-502 in new and retrofitted ice rinks. See the discussion on these blends under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(6) CFC-12 and R-502 Cold Storage Warehouses, Retrofit

Please note that different temperature regimes may affect the applicability of substitutes within this end-use.

(a) R-406A

R-406A, which consists of HCFC-22, HCFC-142b, and isobutane, is acceptable as a substitute for CFC-12 and R-502 in retrofitted cold storage warehouses. See the discussion on R-406A under retrofitted R-500 centrifugal chillers.

(b) R-407A and R-407B

R-407A and R-407B, which consist of HFC-134a, HFC-32, and HFC-125, are acceptable as substitutes for CFC-12 and R-502 in retrofitted cold storage warehouses. See the discussion on these blends under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(c) HCFC Blend Epsilon

HCFC Blend Epsilon, which consists of HCFC-22, HFC-143a, and HFC-125, is acceptable as a substitute for CFC-12 and R-502 in retrofitted cold storage warehouses. See the discussion on HCFC Blend Epsilon under retrofitted industrial process refrigeration.

(7) CFC-12 and R-502 Cold Storage Warehouses, New

Please note that different temperature regimes may affect the applicability of substitutes within this end-use.

(a) R-407A and R-407B

R-407A and R-407B, which consist of HFC-134a, HFC-32, and HFC-125, are acceptable as substitutes for CFC-12 and R-502 in new cold storage warehouses. See thediscus-

sion on these blends under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(8) CFC-12, R-500, and R-502 Refrigerated Transport, Retrofit

Please note that different temperature regimes may affect the applicability of substitutes within this end-use.

(a) R-406A

R-406A, which consists of HCFC-22, HCFC-142b, and isobutane, is acceptable as a substitute for CFC-12, R-500, and R-502 in retrofitted refrigerated transport. See the discussion on R-406A under retrofitted R-500 centrifugal chillers.

(b) R-407A and R-407B

R-407A and R-407B, which consist of HFC-134a, HFC-32, and HFC-125, are acceptable as substitutes for CFC-12, R-500, and R-502 in retrofitted refrigerated transport. See the discussion on these blends under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(c) HCFC Blend Gamma

HCFC Blend Gamma, which consists of HCFC-22, HCFC-142b, and HCFC-124, is acceptable as a substitute for CFC-12, R-500, and R-502 in retrofitted refrigerated transport. Because HCFC-22, HCFC-142b, and HCFC-124 contribute to ozone depletion, this blend is considered a transitional alternative. Regulations regarding recycling and reclamation issued under section 608 of the Clean Air Act apply to this blend. HCFC-142b has one of the highest ODPs among the HCFCs, while HCFC-124 has one of the lowest. The GWPs ofHCFC-22 and HCFC-142b are somewhat high. Although HCFC-142b is flammable, the blend is not. Leak testing has demonstrated that its composition never becomes flammable.

(d) HCFC Blend Epsilon

HCFC Blend Epsilon, which consists of HCFC-22, HFC-143a, and HFC-125, is acceptable as a substitute for CFC-12, R-500, and R-502 in retrofitted refrigerated transport. See the discussion on HCFC Blend Epsilon under retrofitted CFC-11, CFC-12,

and R-502 industrial process refrigeration.

(9) CFC-12, R-500, and R-502 Refrigerated Transport, New

Please note that different temperature regimes may affect the applicability of substitutes within this end-use.

(a) R-407A and R-407B

R-407A and R-407B, which consist of HFC-134a, HFC-32, and HFC-125, are acceptable as substitutes for CFC-12, R-500, and R-502 in new refrigerated transport. See the discussion on these blends under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(10) CFC-12 and R-502 Retail Food Refrigeration, Retrofit

Please note that different temperature regimes may affect the applicability of substitutes within this end-use.

(a) R-406A

R-406A, which consists of HCFC-22, HCFC-142b, and isobutane, is acceptable as a substitute for CFC-12 and R-502 in retrofitted retail food refrigeration. See the discussion on R-406A under retrofitted R-500 centrifugal chillers.

(b) R-407A and R-407B

R-407A and R-407B, which consist of HFC-134a, HFC-32, and HFC-125, are acceptable as substitutes for CFC-12 and R-502 in retrofitted retail food refrigeration. See the discussion on these blends under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(c) HCFC Blend Gamma

HCFC Blend Gamma, which consists of HCFC-22, HCFC-142b, and HCFC-124, is acceptable as a substitute for CFC-12 and R-502 in retrofitted retail food refrigeration. See the discussion on HCFC Blend Gamma under retrofitted CFC-12, R-500, and CFC-502 refrigerated transport.

(d) HCFC Blend Epsilon

HCFC Blend Epsilon, which consists of HCFC-22, HFC-143a, and HFC-125, is acceptable as a substitute for CFC-12 and R-502 in retrofitted retail food refrigeration. See

the discussion on HCFC Blend Epsilon under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(11) CFC-12 and R-502 Retail Food Refrigeration, New

Please note that different temperature regimes may affect the applicability of substitutes within this end-use.

(a) R-407A and R-407B

R-407A and R-407B, which consist of HFC-134a, HFC-32, and HFC-125, are acceptable as substitutes for CFC-12 and R-502 in new retail food refrigeration. See thediscussion on these blends under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(12) CFC-12 and R-502 Commercial Ice Machines, Retrofit

Please note that different temperature regimes may affect the applicability of substitutes within this end-use.

(a) R-406A

R-406A, which consists of HCFC-22, HCFC-142b, and isobutane, is acceptable as a substitute for CFC-12 and R-502 in retrofitted commercial ice machines. See the discussion on R-406A under retrofitted R-500 centrifugal chillers.

(b) R-407A and R-407B

R-407A and R-407B, which consist of HFC-134a, HFC-32, and HFC-125, are acceptable as substitutes for CFC-12 and R-502 in retrofitted commercial ice machines. See the discussion on these blends under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(c) HCFC Blend Gamma

HCFC Blend Gamma, which consists of HCFC-22, HCFC-142b, and HCFC-124, is acceptable as a substitute for CFC-12 and R-502 in retrofitted commercial ice machines. See the discussion on HCFC Blend Gamma under retrofitted CFC-12, R-500, and CFC-502 refrigerated transport.

(d) HCFC Blend Epsilon

HCFC Blend Epsilon, which consists of HCFC-22, HFC-143a, and HFC-125, is

acceptable as a substitute for CFC-12 and R-502 in retrofitted commercial ice machines. Seethe discussion on HCFC Blend Epsilon under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(13) CFC-12 and R-502 Commercial Ice Machines, New

Please note that different temperature regimes may affect the applicability of substitutes within this end-use.

(a) R-407A and R-407B

R-407A and R-407B, which consist of HFC-134a, HFC-32, and HFC-125, are acceptable as substitutes for CFC-12 and R-502 in new commercial ice machines. See the discussion on these blends under retrofitted CFC-11, CFC-12, and R-502 industrial process refrigeration.

(14) CFC-12 and R-502 Vending Machines, Retrofit

(a) R-404A

R-404A, which consists of HFC-125, HFC-143a, and HFC-134a, is acceptable as a substitute for CFC-12 and R-502 in retrofitted vending machines. None of this blend's constituents contains chlorine, and thus this blend poses no threat to stratospheric ozone. However, HFC-125 and HFC-143a have very high GWPs, and the GWP of HFC-134a is somewhat high. EPA strongly encourages recycling and reclamation of this blend to reduce its direct global warming impact. Although HFC-143a is flammable, the blend is not. Leak testing has demonstrated that its composition never becomes flammable.

(b) R-406A

R-406A, which consists of HCFC-22, HCFC-142b, and isobutane, is acceptable as a substitute for CFC-12 and R-502 in retrofitted vending machines. See the discussion on R-406A under retrofitted R-500 centrifugal chillers.

(c) R-507

R-507, which consists of HFC-125 and HFC-143a, is acceptable as a substitute for CFC-12 and R-502 in retrofitted vending machines. None of this blend's constituents contains chlorine, and thus this blend poses no threat to stratospheric ozone. However, HFC-125 and HFC-143a have very high GWPs. EPA strongly encourages recycling and

reclamation of this blend in order to reduce its direct global warming impact. Although HFC-143a is flammable, the blend is not. It is an azeotrope, so it will not fractionate during operation. Leak testing has demonstrated that its composition never becomes flammable.

(d) HCFC Blend Gamma

HCFC Blend Gamma, which consists of HCFC-22, HCFC-142b, and HCFC-124, is acceptable as a substitute for CFC-12 and R-502 in retrofitted vending machines. See the discussion on HCFC Blend Gamma under retrofitted CFC-12, R-500, and CFC-502 refrigerated transport.

(15) CFC-12 Vending Machines, New

(a) R-404A

R-404A, which consists of HFC-125, HFC-143a, and HFC-134a, is acceptable as a substitute for CFC-12 and R-502 in new vending machines. See the discussion on this blend under retrofitted CFC-12 and R-502 vending machines.

(b) R-507

R-507, which consists of HFC-125 and HFC-143a, is acceptable as a substitute for CFC-12 and R-502 in new vending machines. See the discussion on this blend under retrofitted CFC-12 and R-502 vending machines.

(16) CFC-12 Water Coolers, Retrofit

(a) R-406A

R-406A, which consists of HCFC-22, HCFC-142b, and isobutane, is acceptable as a substitute for CFC-12 in retrofitted water coolers. See the discussion on R-406A under retrofitted R-500 centrifugal chillers.

(b) HCFC Blend Gamma

HCFC Blend Gamma, which consists of HCFC-22, HCFC-142b, and HCFC-124, is acceptable as a substitute for CFC-12 in retrofitted water coolers. See the discussion on HCFC Blend Gamma under retrofitted CFC-12, R-500, and CFC-502 refrigerated transport.

(17) CFC-12 Household Refrigerators, Retrofit

(a) R-406A

R-406A, which consists of HCFC-22, HCFC-142b, and isobutane, is acceptable as a substitute for CFC-12 in retrofitted household refrigerators. See the discussion on R-406A under retrofitted R-500 centrifugal chillers.

(b) HCFC Blend Gamma

HCFC Blend Gamma, which consists of HCFC-22, HCFC-142b, and HCFC-124, is acceptable as a substitute for CFC-12 in retrofitted household refrigerators. See the discussion on HCFC Blend Gamma under retrofitted CFC-12, R-500, and CFC-502 refrigerated transport.

(18) CFC-12 and R-502 Household Freezers, Retrofit

(a) R-402A and R-402B

R-402A and R-402B, which consist of HCFC-22, propane, and HFC-125, are acceptable as substitutes for CFC-11, CFC-12, and R-502 in retrofitted household freezers. HCFC-22 contributes to ozone depletion, and will be phased out according to the accelerated schedule (published 12/10/93, 58 FR 65018), although it has a lower ODP than CFC-12. The GWP of HFC-125 is very high and that of HCFC-22 is somewhat high. Although these blends contain one flammable constituent, propane, the blends themselves are not flammable. In addition, while testing demonstrated that the vapor and liquid compositions changed during leaks, neither phase became flammable.

(b) R-404A

R-404A, which consists of HFC-125, HFC-143a, and HFC-134a, is acceptable as a substitute for CFC-12 and R-502 in retrofitted household freezers. See the discussion on this blend under retrofitted CFC-12 and R-502 vending machines.

(c) R-406A

R-406A, which consists of HCFC-22, HCFC-142b, and isobutane, is acceptable as a substitute for CFC-12 in retrofitted household freezers. See the discussion on R-406A under retrofitted R-500 centrifugal chillers.

(d) R-507

R-507, which consists of HFC-125 and HFC-143a, is acceptable as a substitute for

CFC-12 and R-502 in retrofitted household freezers. See the discussion on this blend under retrofitted CFC-12 and R-502 vending machines.

(e) HCFC Blend Gamma

HCFC Blend Gamma, which consists of HCFC-22, HCFC-142b, and HCFC-124, is acceptable as a substitute for CFC-12 in retrofitted household freezers. See the discussion on HCFC Blend Gamma under retrofitted CFC-12, R-500, and CFC-502 refrigerated transport.

(19) CFC-12 and R-502 Household Freezers, New

(a) R-402A and R-402B

R-402A and R-402B, which consist of HCFC-22, propane, and HFC-125, are acceptable as substitutes for CFC-11, CFC-12, and R-502 in retrofitted household freezers. See the discussion on R-402A and R-402B under retrofitted household freezers.

(b) R-404A

R-404A, which consists of HFC-125, HFC-143a, and HFC-134a, is acceptable as a substitute for CFC-12 and R-502 in new household freezers. See the discussion on this blend under retrofitted CFC-12 and R-502 vending machines.

(c) R-507

R-507, which consists of HFC-125 and HFC-143a, is acceptable as a substitute for CFC-12 and R-502 in new household freezers. See the discussion on this blend under retrofitted CFC-12 and R-502 vending machines.

(20) CFC-12 and R-500 Residential Dehumidifiers, Retrofit

Please note that different temperature regimes may affect the applicability of substitutes within this end-use.

(a) R-406A

R-406A, which consists of HCFC-22, HCFC-142b, and isobutane, is acceptable as a substitute for CFC-12 and R-500 in retrofitted residential dehumidifiers. See the discussion on R-406A under retrofitted R-500 centrifugal chillers.

(b) HCFC Blend Gamma

HCFC Blend Gamma, which consists of HCFC-22, HCFC-142b, and HCFC-124, is

acceptable as a substitute for CFC-12 and R-500 in retrofitted residential dehumidifiers. See the discussion on HCFC Blend Gamma under retrofitted CFC-12, R-500, and CFC-502 refrigerated transport.

(21) CFC-12 Automobile Air Conditioners, Retrofit and New

A smooth transition to the use of substitutes strongly depends on the continued purity of the recycled CFC-12 supply. The existence of several substitutes in this end-use may increased the likelihood of significant cross-contamination. To address this increased risk, EPA is proposing several use conditions on the use of all motor vehicle air conditioning refrigerants. Please refer to the notice of proposed rulemaking, soon to be issued, for more information.

(22) CFC-12 Non-Automobile Motor Vehicle Air Conditioners, Retrofit and New

(a) HCFC-22

HCFC-22 is acceptable as a substitute for CFC-12 in retrofitted and new CFC-12 Non-Automobile Motor Vehicle Air Conditioners. In some situations, HCFC-22 may be used as a retrofit refrigerant in bus and rail car air conditioning systems originally designed to use CFC-12. In addition, while HCFC-22 is the primary refrigerant in these uses, EPA islisting it as an acceptable substitute for CFC-12 in new systems in order to remove confusion about its usefulness. Please note that HCFC-22 is only acceptable in motor vehicles other than automobiles. Design differences render HCFC-22 ineffective in cars. In fact, HCFC-22 may damage automobile air conditioners. HCFC-22 does contribute to ozone depletion and will therefore be phased out according to the accelerated schedule (published 12/10/93, 58 FR 65018). It is therefore covered by regulations issued under section 608 of the CAA. HCFC-22 is nonflammable.

(23) Non-mechanical Heat Transfer, Retrofit and New

EPA did not review substitues for this end-use as part of the SNAP FRM, nor did it propose to include this end-use in the refrigeration and air conditioning sector in the NPRM (58 FR 28094). However, the Agency has developed a better understanding of the

volumes likely to be used as coolants, and this new information has led EPA to reconsider its earlier position that heat transfer systems constitute small uses. Therefore, EPA has included this end-use within the refrigeration and air conditioning sector. In a subsequent proposal, EPA plans to propose narrowed use limits for several substitutes in this end-use.

(24) CFC-13, R-13B1, and R-503 Very Low Temperature Refrigeration, Retrofit and New

This type of refrigeration requires temperatures well below those achieved with R-502 or HCFC-22. Because these systems are used for purposes such as freezing blood or for simulating extreme conditions for testing, extremely low leakage rates are essential. A limited number of substitutes have been identified that are capable of meeting technical requirements. These substitutes all contain components with extremely high GWPS, andEPA is concerned about their potential contribution to global warming. However, under SNAP, EPA intends to only find those substitutes unacceptable that clearly present greater overall risk. Given this framework, EPA finds these high-GWP substitutes acceptable. At the same time, EPA strongly urges industry to develop new alternatives for this end-use that do not contain substances with such high GWPs and long lifetimes.

(a) HFC-23

HFC-23 is acceptable as a substitute for CFC-13, R-13B1, and R-503 in retrofitted and new very low temperature refrigeration. HFC-23 has an extremely high GWP of 9000 and a lifetime of 280 years. Its GWP is the highest among the HFCs, and its lifetime is exceeded only by the PFCs. EPA believes it could contribute significantly to global warming. In addition, the long lifetime of HFC-23 means any global warming or other effects would be essentially irreversible. While the current rule issued under section 608 of the CAA does not require recycling and recovery of HFC-23, or leak repair for systems using HFC-23, EPA strongly encourages users to anticipate future rulemakings with voluntary compliance. In particular, EPA urges users to reduce leakage and recover and recycle HFC-23 during equipment servicing and upon the retirement of equipment.

HFC-23 is nonflammable and does not deplete ozone.

(b) R-403B

R-403B, which consists of HCFC-22, R-218, and propane, is acceptable as a substitute for CFC-13, R-13B1, and R-503 in retrofitted and new very low temperature refrigeration. Because HCFC-22 contributes to ozone depletion, this blend is considered a transitional alternative. Regulations regarding recycling and reclamation issued under section608 of the Clean Air Act apply to this blend. R-218, or perfluoropropane, is an extremely long-lived substance with an extremely high GWP. EPA believes this blend could significantly contribute to global warming. In addition, the long lifetimes of R-218 means global warming and other effects would be essentially irreversible. R-403B is only acceptable as a substitute for the refrigerants listed above. The GWP of HCFC-22 and HCFC-142b are also somewhat high. Although propane is flammable, the blend is not. Leak testing has demonstrated that the blend's composition never becomes flammable. In a proposed rulemaking soon to be issued, EPA intends to propose R-403B unacceptable as a substitute for R-502 in all end-uses because other substitutes have been identified which do not exhibit such extreme GWPs or lifetimes.

(c) PFC Blend Alpha

PFC Blend Alpha, which contains HFC-23 and R-116, is acceptable as a substitute for CFC-13, R-13B1, and R-503 in retrofitted and new very low temperature refrigeration. Both components of this blend exhibit extremely high GWPs and long lifetimes. HFC-23 has a GWP of 9,000 and a lifetime of 280 years, and R-116, perfluoroethane, has a GWP of 9,000 and a lifetime of 10,000 years. EPA believes this blend could significantly contribute to global warming if allowed to escape refrigeration systems. In addition, the long lifetimes of R-116 and HFC-23 mean any global warming or other effects would be essentially irreversible. While the current rule issued under section 608 of the CAA does not require recycling and recovery of this blend, or leak repair for systems using it, EPA strongly encourages users to anticipate future rulemakings with voluntary compliance. In particular, EPA urges users to reduce leakage and recover and recycle HFC-23 during equipmentservicing and upon the retirement of equipment. This blend is nonflammable

and does not deplete ozone.

B. Foams

1. Clarification from March 18, 1994 Final Rulemaking

In Section IX.E. Foams, under the listing decisions for rigid polyurethane and polyisocyanurate laminate boardstock (59 FR 13085), the narrative under substitute (e) HCFC-22 / HCFC-141b incorrectly reads as follows: "The *HCFC-22/HCFC-142b* blend is acceptable as a substitute for CFC-11 in rigid polyurethane and polyisocyanurate laminate boardstock foams." This sentence should read *HCFC-22/HCFC-141b*. The Agency regrets any confusion this error may have caused.

Further, the end-use titled "Phenolic Insulation Board" requires clarification. In this end-use the Agency includes foam products manufactured from both the discontinuous block (or bun) process and the continuous lamination process. Henceforth, this end-use will be referred to as "Phenolic Insulation Boardstock and Bunstock Foam."

2. New Listing Decisions

a. Acceptable Substitutes

(1) Rigid Polyurethane and Polyisocyanurate Laminated Boardstock

(a) Electroset Technology

The Electroset Manufacturing Technology is an acceptable substitute for CFC-11 blown rigid polyurethane and polyisocyanurate laminated boardstock foams. This proprietary manufacturing process, developed by the U.S. Navy, transforms organic casting resins intoelectrosettable foaming compounds. These compounds are made electrically semiconductive with the addition of electrically polarizable particles, and if necessary, an electrically conductive fluid. This process enables foam manufacturers to electrically accelerate the speed at which they set (i.e., harden) and cure (i.e. solidify). Other characteristics such as density, compressibility, adhesion, and shear strength can also be electrically controlled. Potential health and environmental risks for this technology are considered similar to or less than those of other acceptable substitutes for this end-use. Risk is expected to vary based on the quantity of electrically polarizable

particles added in the polymer and whether other electrically conductive fluids are added to the formulation. Of the six potential electrically foaming agents reviewed by the Agency, none represented a significant risk under the SNAP criteria for evaluation. Adequate workplace precautions such as workplace ventilation were presumed. For additional detail see, "SNAP Evaluation for Electroset Technology."

(2) Rigid Polyurethane Appliance

(a) Electroset Technology

The Electroset Manufacturing Technology is an acceptable substitute for CFC-11 blown rigid polyurethane and polyisocyanurate laminated boardstock foams. See discussion above.

(3) Rigid Polyurethane Spray and Commercial Refrigeration, and Sandwich Panels

(a) Electroset Technology

The Electroset Manufacturing Technology is an acceptable substitute for CFC-11 blown rigid polyurethane and polyisocyanurate laminated boardstock foams. See discussion above.

(4) Rigid Polyurethane Slabstock and Other Foams

(a) Electroset Technology

The Electroset Manufacturing Technology is an acceptable substitute for CFC-11 blown rigid polyurethane and polyisocyanurate laminated boardstock foams. See discussion above.

(5) Polystyrene Extruded Boardstock and Billet

(a) HFC-143a

HFC-143a is acceptable as an alternative to CFC-12 in polystyrene boardstock and billet foams. HFC-143a has a higher global warming potential (GWP) than other acceptable substitutes for this end-use.

(b) Electroset Technology

The Electroset Manufacturing Technology is an acceptable substitute for CFC-11 blown rigid polyurethane and polyisocyanurate laminated boardstock foams. See

discussion above.

(6) Phenolic Insulation Boardstock and Bunstock Foam

(a) Electroset Technology

The Electroset Manufacturing Technology is an acceptable substitute for CFC-11 blown rigid polyurethane and polyisocyanurate laminated boardstock foams. See discussion above.

(7) Polyurethane Flexible

(a) Saturated Light Hydrocarbons C3-C6

Saturated light hydrocarbons C3-C6 (and blends thereof) are acceptable as substitutes for CFC-11 and methyl chloroform in polyurethane flexible foam. Saturated light hydrocarbons C3-C6 offer the potential of a non-ozone-depleting alternative to the use of CFC-11 blowing agents in polyurethane flexible foams. Plant modifications, however, may be necessary to accommodate the flammability of hydrocarbons. Saturated light hydrocarbons C3-C6 are VOCs and are subject to control as such under Title I of the Clean Air Act.

(b) Electroset Technology

The Electroset Manufacturing Technology is an acceptable substitute for CFC-11 blown rigid polyurethane and polyisocyanurate laminated boardstock foams. See discussion above.

(8) Polyurethane Integral Skin

(a) Electroset Technology

The Electroset Manufacturing Technology is an acceptable substitute for CFC-11 blown rigid polyurethane and polyisocyanurate laminated boardstock foams. See discussion above.

(9) Polystyrene Extruded Sheet

(a) Electroset Technology

The Electroset Manufacturing Technology is an acceptable substitute for CFC-11 blown rigid polyurethane and polyisocyanurate laminated boardstock foams. See discussion above.

(10) Polyolefin Foam

(a) Methylene Chloride

Methylene chloride is acceptable as a substitute for CFC-11, CFC-12 and CFC-114 in polyolefin foams. Methylene chloride is a non-ozone-depleting and non-global warming alternative blowing agent. Nevertheless, it does pose potential health and safety concerns. In addition to occupational and worker safety standards, some local and regional restrictions apply to the use of methylene chloride. To assess risks in the Polyolefin foam sector, EPA used data collected by the Occupational Safety and Health Administration (OSHA) for the proposed revision of the permissible exposure level (PEL) for methylene chloride. The Agency's estimate for total population risk for methylene chloride was based on average plant emissions derived from OSHA's analysis, and while not negligible, was within the range of existing Agency decisions on acceptable risk. For further detail, refer to the SNAP background document entitled, "Risk Screen on the Use of Methylene Chloride in Polyolefin Foams for Class I Ozone-Depleting Substances: Foams, June, 1994." Users of this substitute should note that methylene chloride will be subject to future controls for hazardous air pollutants under Title III section 112 of the Clean Air Act.

(b) Polyolefin Chemical Blend A

Polyolefin Chemical Blend A is an acceptable substitute for CFC-11, CFC-12 and CFC-114 in polyolefin foams. Polyolefin Chemical Blend A is a proprietary combination of blowing agents submitted by a polyolefin foam manufacturer.

(c) HFC-152a / Saturated Light Hydrocarbons C3 - C6 Blends

HFC-152a / Saturated Light Hydrocarbons C3-C6 blends are acceptable substitutes for CFC-11, CFC-12 and CFC-114 in polyolefin foams. Both HFC-152a and saturated light hydrocarbons C3-C6 are flammable. Plant modifications may be necessary to accommodate this characteristic. Saturated light hydrocarbons C3-C6 are volatile organic compounds (VOCs) and are subject to control as such under Title I of the Clean Air Act.

(d) Electroset Technology

The Electroset Manufacturing Technology is an acceptable substitute for CFC-11 blown rigid polyurethane and polyisocyanurate laminated boardstock foams. See discussion above.

C. Solvent Cleaning

1. New Listing Decisions

a. Acceptable Substitutes

(1) Metals Cleaning

(a) Trans-1,2-dichloroethlyene.

Trans-1,2-dichloroethylene is acceptable as an alternative to MCF and CFC-113 in metals cleaning.

(b) Volatile Methyl Siloxanes

Octamethylcyclotetrasiloxanes and decamethylcyclo pentasiloxanes are acceptable alternatives to MCF and CFC-113 in metals cleaning. Evaluation of other VMS's is ongoing. (2) Electronics Cleaning

(a) Trans-1,2-dichloroethlyene.

Trans-1,2-dichloroethylene is acceptable as an alternative to MCF and CFC-113 in electronics cold cleaning.

(b) Volatile Methyl Siloxanes

Octamethylcyclotetrasiloxanes and decamethylcyclopentasiloxanes are acceptable alternatives to MCF and CFC-113 in electronics cleaning. Evaluation of other VMS's is on-going.

(3) Precision Cleaning

(a) Trans-1,2-dichloroethlyene.

Trans-1,2-dichloroethylene is acceptable as an alternative to MCF and CFC-113 in precision cleaning.

(b) HCFC-123

HCFC-123 is an acceptable substitute for CFC-113 and MCF in precision cleaning. New toxicity data has led to an upward revision of the company set workplace exposure limit (AEL) of 30 ppm. The Agency believes that under normal conditions of use this

limit is attainable.

(c) Volatile Methyl Siloxanes

Octamethylcyclotetrasiloxanes and decamethylcyclo pentasiloxanes are acceptable alternatives to MCF and CFC-113 in precision cleaning. Evaluation of other VMS's is ongoing.

D. Fire Suppression and Explosion Protection

1. Weight and Volume Equivalence of Halon Substitutes

In the SNAP Rulemaking published March 18, 1994 (59 FR 13043), EPA included weight and volume equivalence data in the discussion of halon substitutes. This data was derived from either of two sources. EPA used manufacturer data when available, otherwise the data was taken from the background document entitled "Characterization of Risk from the Use of Substitutes for Class I Ozone-Depleting Substances: Fire Extinguishing and Explosion Protection (Halon Substitutes)." While this data was presented in the Rulemaking for informational purposes only to establish a relative concept, the variability of methodologies for calculating these values has generated some confusion in the regulated and user community. Therefore, at EPA's request, the Technical Committee of the Halon Alternatives Research Corporation has developed an agreed upon set of data for determining weight and volume equivalence of halon substitutes.

The following table presents weight and volume equivalents for certain halon substitutes when compared to Halon 1301. The equivalents were calculated using a single, fuel-specific design concentration (heptane); therefore, they do not represent the exact weight or volume of the agent needed to protect any specific space against any specific hazard. The information used to calculate the equivalents was obtained from agent manufacturers andNFPA 2001, "Standard on Clean Agent Fire Extinguishing Systems." Equivalents are included for general comparison and informational purposes only.

Fire suppression agents must be evaluated in the context of the fire extinguishing system equipment with which they are used. Design concentration, and weight and volume equivalents are only meaningful when evaluated in specific system hardware

configurations. This is especially important when comparing storage volume where storage container fill density varies with the equipment used. Agent fire suppression performance will vary with the system used and the detailed design of the system. Therefore, fire suppression agent manufacturers do not generally recommend design concentrations as these are also a function of the system hardware in which they are used. Hence, these data are provided for general guidance only and do not reflect a recommendation for system design or a basis for rigorous quantitative comparison.

1	2	3	4	5	6	7
Agent	Design Concentration					
(% Vol.)		lb / 1000 ft^3 @ 70°F				
per NFPA 2001[5]		lb agent				
lb Halon 1301 [6]				ft^3 / agent		
ft^3 / 1301 [7]					Maximum Fill	
Density (lb / ft^3) [8]						Stor-
age Pressure						
(psi) [8]						
Halon 1301	5 [4]	20.6	1.0	1.0	70	360
HFC-23	16 [1]	34.8	1.7	2.2	54	609
HFC-125	10.9 [1]	38.7	1.9	2.3	58	166
HCFC-124	8.5 [1,2]	33.8	1.6	1.6	71	195
IG-541	37.5 [1,2]	42.0	2.0	10.5 [10]	N / A [9]	2175

FC-3-1-10	6 [1,2]	39.3	1.9	1.7	80
	360				
HCFC Blend A	8.6 [3]	22.6	1.1	1.4	56
	360				
HFC-227ea	7 [1,2]	34.1	1.7	1.6	72
	360				

Notes:
(1) Based on 120 percent of cup burner value for n-heptane
(2) Based on 120 percent of cup burner verified by listing/approval tests
(3) Based on listing/approval tests, cup burner value approx. 10 percent
(4) Minimum design concentration per NFPA 12A, cup burner value approx. 3 percent
(5) Design concentration per NFPA 2001
(6) Ratio of value in Column 3 to value in Column 3 for Halon 1301 (weight equivalents)
(7) Based on ratio in Column 4 to ratio of maximum fill density relative to Halon 1301 (storage volume equivalents)
(8) Per NFPA 2001, NFPA 12A (for Halon 1301)
(9) Approx. storage density of 13.3 lb/ft^3 @ 2175 psi
(10) Based on approx. storage density of IG-541 @ 2175 psi

Weight and volume equivalencies based on cup burner data are much less meaningful for streaming agents than for total flood agents. One needs to consider performance of the agents and equipment in larger-scale standardized tests.

2. Use of CFCs and HCFCs in Portable Extinguishers

In this notice, EPA is clarifying the relationship between CAAA section 610 and section 612 regulations. Under section 610(b) (58 FR 4768; January 15, 1993), CFCs are banned from sale or distribution in all portable fire extinguishers. Under section 610(d) (58 FR 69637, December 30, 1993), HCFCs in pressurized dispensers are banned from sale or distribution. However, section 610(d) excludes HCFCs which are part of an installed 'system,' and therefore exempted total flooding systems and those streaming applications which incorporate fixed, automatic systems (58 FR 69646). Further, section 610(d) only allows the sale of a portable fire extinguisher containing HCFCs where other agents are not suitable for the intended applications. Suitability includes the commercial availability of the agent and the ability of the agent to suppress a fire in progress without damaging the equipment requiring protection (58 FR 69648). Because alternatives are available for residential consumer uses, section 610(d) banned the sale and use of HCFCs in portable fire extinguishers for residential consumer applications. However, in

commercial (including industrial and military) settings, the variety of hazards are too broad to make a standardrulemaking, and therefore under section 610(d) EPA has established industry-based mechanisms for controlling the sale of HCFCs to commercial users and owners of watercraft and aircraft. Because section 610(d) already bans CFCs in portable fire extinguishers and HCFCs in residential applications, it is not necessary for them to be listed as unacceptable under SNAP.

The HCFCs and HCFC Blends that are listed as acceptable under SNAP, but that are not acceptable under section 610(d) in residential streaming applications are: HCFC-123, HCFC-124, [HCFC Blend] B, [HCFC Blend] C, and [HCFC Blend] D.

3. New Listing Decisions

a. Acceptable Substitutes

(1) Streaming Agents

(a) HCFC-124

HCFC-124 is acceptable as a Halon 1211 substitute. HCFC-124 has an ODP of 0.02, a 100-year GWP of 440 and an atmospheric lifetime of 7 years. Its extinguishment concentration, based on cup burner tests, is 7.0 per cent, while its cardiotoxic level (LOAEL) is 2.5 per cent in the dog, with no effect (NOAEL) apparent at 1.0 per cent. Actual exposures were assessed using personal monitoring devices, and the Agency concludes that likely exposure levels from its use as a streaming agent do not exceed safe levels when used in a well ventilated area. The manufacturer of portable extinguishers using these agents should include cautionary language on the label indicating the need for ventilation.

This agent is subject to regulations under section 610(d) of the CAA, which stipulates that HCFCs may only be used in portable fire extinguishers where other commerciallyavailable agents are not as effective for the fire hazard. Under section 610(d), HCFCs may not be used in residential extinguishers.

(b) [HCFC Blend] C

[HCFC Blend] C is acceptable as a Halon 1211 substitute. This agent is a proprietary blend of HCFC-123, HCFC-124, HFC-134a, and an additive. The cardiotoxic

LOAEL and NOAEL for HCFC-123 is, respectively, 2.0 per cent and 1.0 per cent; the LOAEL and NOAEL for HCFC-124 is 2.5 per cent and 1.0 per cent; and the LOAEL and NOAEL for HFC-134a is 8.0 per cent and 4.0 per cent respectively. While the manufacturer may, in the future, conduct personal monitoring studies of actual exposure levels of this agent, previous studies conducted for pure HCFC-123 and for pure HCFC-124 have shown that exposure in the breathing zone does not exceed cardiotoxicity values.

The ODP of both HCFC-123 and HCFC-124 is 0.02 while HFC-134a has no ODP since it contains no chlorine. The respective GWP values for HCFC-123, HCFC-124, and HFC-134a are 90, 440, and 1200, relative to CO_2, while their respective atmospheric lifetimes are 2 years, 7 years and 16 years.

This agent is subject to regulations under section 610(d) of the CAA, which stipulates that HCFCs may only be used in portable fire extinguishers where other commercially available agents are not as effective for the fire hazard. Under section 610(d), HCFCs may not be used in residential extinguishers.

(c) [HCFC Blend] D

[HCFC Blend] D is acceptable as a Halon 1211 substitute. This blend is comprised of HCFC-123 plus a proprietary additive, and is intended for large outdoor uses such aswheeled extinguishers. HCFC-123 is currently listed as acceptable for use in non-residential streaming applications. This agent is subject to regulations under section 610(d) of the CAA, which stipulates that HCFCs may only be used in portable fire extinguishers where other commercially available agents are not as effective for the fire hazard. Under section 610(d), HCFCs may not be used in residential extinguishers.

(d) Gelled Halocarbon/Dry Chemical Suspension (formerly Powdered Aerosol B)

Gelled Halocarbon/Dry Chemical Suspension is acceptable as a Halon 1211 substitute. This class of agents is comprised of a variety of blends developed for particular markets. Each blend contains one or more halocarbons, a dry chemical, and a gel which keeps the powder and gas uniform. Both the halocarbon and the dry chemical act on the fire, while the gel is consumed by the fire.

EPA's acceptability listing is extended to any blend comprised of a halocarbon with a cardiotoxic LOAEL of at least 2.0 per cent, in combination with a dry chemical or multipurpose dry chemical that is currently widely used, including monoammonium phosphate (ABC powder), potassium bicarbonate (Purple K powder), and sodium bicarbonate. This listing decision also includes ammonium polyphosphate.

The manufacturer of this technology proposes using several different halocarbons singly and in blends, in combination with one of several dry chemicals or multipurpose dry chemical powders. The halocarbons included in the SNAP submission include HFC-227ea, HFC-125, HFC-134a, and HFC-125 blended with HFC-134a. The cardiotoxic LOAEL and NOAEL of HFC-227ea is, respectively, 10.5 per cent and 9.0 per cent; the LOAEL andNOAEL of HFC-125 is 10.0 per cent and 7.5 per cent; and the LOAEL and NOAEL of HFC-134a is 8.0 per cent and 4.0 per cent respectively. Previous personal monitoring tests of streaming agents using pure HCFC-123 (LOAEL 2.0 per cent; NOAEL 1.0 per cent) and HCFC-124 (LOAEL 2.5 per cent; NOAEL 1.0 per cent) indicate that actual exposure to the breathing zone does not exceed these values. Such tests with agents which pose greater risk of cardiosensitization indicate that HFC-227ea, HFC-125 and HFC-134a can also be used safely in well-ventilated areas. In addition, the quantity of the halocarbons in this technology is approximately half of what a pure halocarbon extinguisher would contain and thus there is a built-in margin of safety as it relates to cardiotoxicity.

While all of the proposed halocarbons have no ODP, the GWP and atmospheric lifetime of HFC-227ea is 2050 and 31 years; of HFC-125 is 3400 and 41 years; and of HFC-134a is 1200 and 16 years.

The dry chemical powders proposed by the manufacturer include ammonium polyphosphate, monoammonium phosphate (MAP), potassium bicarbonate, and sodium bicarbonate. Sodium bicarbonate was among the original dry chemical extinguishers, followed by potassium bicarbonate and monoammonium phosphate which were developed in the 1960s. Thus, these dry chemical agents have been in use for decades. These powders have been considered generally nontoxic, although if not used according

to manufacturers directions they can cause temporary breathing difficulty during and immediately after discharge. Discharge in large quantities may decrease visibility. These powders typically have particle sizes of less than 10 microns up to 75 microns, with most being optimized at 20 to 25 microns. Ammonium polyphosphate has previously been used as a fire retardantadditive to products and coatings, and the manufacturer is introducing it for use as a streaming agent.

Monoammonium phosphate, commonly known as ABC powder, is a general purpose agent which can be used for class A, B and C fires. However, it is corrosive on hard surfaces. Potassium bicarbonate (Purple K) and sodium bicarbonate cannot be used on class A fires, but are used for specific class B and C applications, generally in the commercial sector. Ammonium polyphosphate is most suitable for military uses, because it is not corrosive.

An initial assessment of inhalation toxicology of fine particulates indicates that some risk is posed when the particles are below a certain size compared to the mass per cubic meter in air. Particle sizes less than 10 to 15 microns and a mass above the ACGIH nuisance dust levels raise concerns which need to be further studied should these agents be used in a total flooding application. However, in a streaming application, it is unlikely that the exposure level will exceed ACGIH dust levels. [1]

Documentation of the Threshold Limit Values and Biological Exposure Indices, Fifth Edition, 1986. American Conference of Governmental Industrial Hygienists Inc., Cincinnati, Ohio.

The particle size distribution for these powders was analyzed with a Micromeretics Sedigraph using Sedisperse A-11 as the settling medium. Mesh of various sizes ranging from 40 mesh (420 microns) to 325 mesh (45 microns) is used to filter the powders into a pan, thus leaving a 'pan fraction' of powder particles which are smaller than 45 microns. A sample of the sediment in the pan is mixed in the Sedisperse medium, which is a heavy, high viscosity fluid. An X-ray beam shines through the sample and counts the particles as they drift down.

Using this method, 50 to 75 per cent of the monoammonium phosphate is smaller than 45 microns. Of that portion which is smaller than 45 microns, the median particle size is 20 microns, with 19.5 per cent of the particles being smaller than 10 microns, and 3.0 per cent being smaller than five microns. Thus, up to 15 per cent (.75 x .195) of the entire MAP product is smaller than 10 microns.

Seventy-four to 88 per cent of the potassium bicarbonate is smaller than 45 microns, with a median size of the pan fraction being 17.4 microns. With 28.4 per cent of the pan fraction being ten microns in size, then up to 25 per cent (.284 x 88) of the total potassium bicarbonate product is under ten microns. 11.3 per cent of the pan fraction is under five microns.

Seventy-five to ninety per cent of the sodium bicarbonate is retained in the pan, and therefore is smaller than 45 microns. The median particle size of the pan fraction is 15.0 microns. With 12.2 per cent of the pan fraction being smaller than ten microns, then 11 per cent of the total product is smaller than ten microns. One per cent of the pan fraction is smaller than five microns.

The manufacturer's data indicate that there are two mixtures of ammonium polyphosphate. The P40 mixture has a particle size distribution with 50% of the particles less than 10 microns. The intended market for this agent is military applications. The P30mixture has a distribution with 20% of particles less than 10 microns and 50% less than 30 microns. The intended market for this agent is for use in domestic and industrial kitchens.

E. Sterilants

1. EtO/CO_2 Systems

In the March 18, 1994 Final Rulemaking, EPA described ethylene oxide/carbon dioxide (EtO/CO_2) substitutes for use in medical sterilization. Recently, the Agency has become aware of more information concerning the design and use of EtO/CO_2 systems, which is described in this Notice.

EtO/CO_2 is stored in tanks as a liquified compressed gas mixture. A tube in the tank draws the liquid mixture from the bottom for use as a sterilant. By Department of

Transportation (DOT) regulations, the tank can be filled with liquid to only 60 per cent of its capacity. The remaining 40 per cent capacity above the liquid is called the "headspace."

Liquified compressed gases will vaporize into the headspace of a tank until equilibrium is reached. Each gas in a mixture vaporizes at its own specific rate. In EtO / CO_2 systems, the CO_2 vaporizes much more readily than does the EtO. The CO_2 vaporizes to fill the headspace, and virtually all the EtO remains in the liquid mixture.

The starting liquid / compressed gas mixture is 8.5 per cent EtO and 91.5 per cent CO_2. When a tank is filled, some CO_2 vaporizes to fill the headspace. Because the liquid mixture loses some CO_2 to form this vapor, the percentage of EtO in the mixture is now greater than 8.5 per cent. As liquid leaves the tank, the headspace increases. More CO_2 continues to vaporize into the headspace and the percentage of EtO in the remaining liquid mixture continues to increase. This results in a liquid mixture that grows increasingly EtO-rich until the liquid is fully depleted. At a certain point during depletion, the percentage of EtO in the liquid mixture increases to a point where the mixture may become flammable.

Once the liquid mixture is fully depleted, only the CO_2-rich vapor phase remains in the tank. If the depletion is not noted, the sterilizer could attempt a sterilization cycle using the CO_2-rich vapor. Under these conditions, the vapor will not sterilize effectively.

Two methods of supply control effectively address these problems. The first uses one-tank-per-cycle "unit dose" tanks. The second uses larger, multiple-cycle tanks and a weight-sensing system.

Unit dose tanks hold only enough EtO / CO_2 for a single sterilization cycle. Unit dose tanks are available for several sizes of sterilizer chambers. After a cycle, the depleted tank is replaced with a fresh one. Using all of the gas in one discharge avoids the risks of flammability and ineffective sterilization which occur in multiple-cycle tanks. However, replacing the tank after each cycle is inconvenient. It also increases the risk of accidental exposure.

A weight-sensing system uses the tank for more than one sterilization cycle. To be

safe, such a system must sense when a tank is depleted, before either the liquid mixture becomes flammable or when only ineffective vapors remain in the tank headspace.

For many gas mixtures, a pressure gauge can indicate the amount of gas in a tank. But for EtO / CO_2 systems, tank pressure does not change appreciably during tank depletion. As the liquid is depleted, more CO_2 fills the headspace and keeps the pressure almost constant. But as a tank of EtO / CO_2 is depleted, the weight of the liquid mixture decreases steadily.

A weight-sensing system monitors the weight of a tank as it is depleted. Before the increasingly EtO-rich liquid in the tank becomes flammable, the system switches to a fresh tank. The depleted tank can then be replaced.

Such systems are designed with numerous safety features to prevent accidental exposure. One drawback is that, when depleted, a tank still contains a portion of the original EtO / CO_2 charge. If more EtO / CO_2 were removed, the liquid mixture would approach the point of flammability.

2. New Listing Decisions

a. Acceptable

(1) [HCFC Blend] A

[HCFC] Blend A is acceptable as a medical sterilant substitute for 12/88 CFC-12/EtO. This is the second agent listed under SNAP that can serve as a virtual drop-in replacement for 12/88, enabling users to transition away from CFC-12 without replacing their existing equipment.

Under Title III of the Clean Air Act Amendments of 1990, the Agency is required to regulate any of the 189 hazardous air pollutants (HAPs). Ethylene oxide is a HAP, and the user is alerted to follow all upcoming regulations concerning the use of ethylene oxide, whether used alone or in a blend. Manufacturers and users are alerted to the fact that the Agency has issued a Proposed Rulemaking which includes EtO used in all sterilizers except hospital systems (59 FR 10591, March 7, 1994).

This agent has been registered under FIFRA.

F. Aerosols

1. New Listing Decisions

A. Acceptable Substitutes

(1) Aerosol Solvent

a. Trans-1,2-dichloroethylene

Trans-1,2-dichloroethylene is acceptable as a solvent substitute for CFC-113 and MCF in aerosols.

IV. Substitutes Pending Review

The Agency describes submissions as pending if data are incomplete or for which the 90-day review period is underway and EPA has not yet reached a final decision. For submissions that are incomplete, the Agency will contact the submitter to determine a schedule for providing the missing information if the Agency needs to extend the 90-day review period. EPA will use its authority under section 114 of the Clean Air Act to gather this information, if necessary. Any delay of the review period does not affect a manufacturer's ability to sell a product 90 days after notification of the Agency. Substitutes currently pending completion of review are listed in Appendix A.

V. Additional Information

Contact the Stratospheric Protection Hotline at 1-800-296-1996, Monday-Friday, between the hours of 10:00 a.m. and 4:00 p.m. (Eastern Standard Time).

For more information on the Agency's process for administering the SNAP program or criteria for evaluation of substitutes, refer to the SNAP final rulemaking published in the Federal Register on March 18, 1994 (59 FR 13044). Federal Register notices can be ordered from the Government Printing Office Order Desk (202) 783-3238; the citation is thedate of publication. This notice can also be retrieved electronically from EPA's Technology Transfer Network (TTN), Clean Air Act Amendment Bulletin Board. If you have a 1200 or 2400 bps modem, dial (919) 541-5742. If you have a 9600 bps modem, dial (919) 541-1447. For assistance in accessing this service, call (919) 541-5384.

List of Subjects in 40 CFR Part 9

Environmental Protection, Reporting and Recordkeeping requirements.

List of Subjects in 40 CFR Part 82

Environmental Protection, Administrative Practice and Procedure, Air Pollution Control, Reporting and Recordkeeping Requirements.

Date: _____

_____

Mary D. Nichols,
Assistant Administrator

APPENDIX A: SUMMARY OF ACCEPTABLE AND PENDING DECISIONS

REFRIGERANTS
ACCEPTABLE SUBSTITUTES

End-Use	Substitute	Decision	Comments
R-500 Centrifugal Chillers (Retrofit)	R-406A	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.
R-500 Centrifugal Chillers (New Equipment/NIKs)	R-406A	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.

CFC-11, CFC-12, R-502 Industrial Process Refrigeration (Retrofit)

	HCFC-123	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.
	R-406A	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.
	R-407A	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
	R-407B	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
	HCFC Blend Epsilon	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.

CFC-11, CFC-12, R-502 Industrial Process Refrigeration (New Equipment/NIKs)

	HCFC-123	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.
	R-407A	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
	R-407B	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.

CFC-13, R-13B1, R-503 Industrial Process Refrigeration (Retrofit and New Equipment/NIKs)

	HFC-23	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
	R-403B	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.

PFC Blend Alpha Acceptable EPA strongly recommends the containment and reclamation of this substitute.

CFC-12, R-502 Ice Skating Rinks (Retrofit and New)

R-407A Acceptable EPA strongly recommends the containment and reclamation of this substitute.

R-407B Acceptable EPA strongly recommends the containment and reclamation of this substitute.

CFC-12, R-502 Cold Storage Warehouses (Retrofit)

R-406A Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

R-407A Acceptable EPA strongly recommends the containment and reclamation of this substitute.

R-407B Acceptable EPA strongly recommends the containment and reclamation of this substitute.

HCFC Blend Epsilon Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

CFC-12, R-502 Cold Storage Warehouses (New Equipment/NIKs)

R-407A Acceptable EPA strongly recommends the containment and reclamation of this substitute.

R-407B Acceptable EPA strongly recommends the containment and reclamation of this substitute.

CFC-12, R-500, R-502 Refrigerated Transport (Retrofit)

R-406A Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

R-407A Acceptable EPA strongly recommends the containment and reclamation of this substitute.

R-407B Acceptable EPA strongly recommends the containment and reclamation of this substitute.

HCFC Blend Gamma Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

HCFC Blend Epsilon Acceptable This substitute is subject

to containment and recovery regulations covering HCFCs.

CFC-12, R-500, R-502 Refrigerated Transport (New Equipment/NIKs)

R-407A	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
R-407B	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.

CFC-12, R-502 Retail Food Refrigeration (Retrofit)

R-406A	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.
R-407A	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
R-407B	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
HCFC Blend Gamma	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.
HCFC Blend Epsilon	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.

CFC-12, R-502 Retail Food Refrigeration (New Equipment/NIKs)

R-407A	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
R-407B	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.

CFC-12, R-502 Commercial Ice Machines (Retrofit)

R-406A	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.
R-407A	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
R-407B	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
HCFC Blend Gamma	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.
HCFC Blend Epsilon	Acceptable	This substitute is subject

to containment and recovery regulations covering HCFCs.

CFC-12, R-502 Commercial Ice Machines (New Equipment / NIKs)

R-407A	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
R-407B	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.

CFC-12 Vending Machines (Retrofit)

R-404A	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
R-406A	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.
R-507	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
HCFC Blend Gamma	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.

CFC-12 Vending Machines (New Equipment / NIKs)

R-404A	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
R-507	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.

CFC-12 Water Coolers (Retrofit)

R-406A	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.
HCFC Blend Gamma	Acceptable	This substitute is subject to containment and recovery regulations covering HCFCs.

CFC-12 Household Refrigerators (Retrofit)

R-406A	Acceptable	This substitute is subject to contain-

ment and recovery regulations covering HCFCs.

HCFC Blend Gamma Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

CFC-12, R-502 Household Freezers (Retrofit)

R-402A Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

R-402B Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

R-404A Acceptable EPA strongly recommends the containment and reclamation of this substitute.

R-406A Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

R-507 Acceptable EPA strongly recommends the containment and reclamation of this substitute.

HCFC Blend Gamma Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

CFC-12, R-502 Household Freezers (New Equipment / NIKs)

R-402A Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

R-402B Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

R-404A Acceptable EPA strongly recommends the containment and reclamation of this substitute.

R-507 Acceptable EPA strongly recommends the containment and reclamation of this substitute.

CFC-12, R-500 Residential Dehumidifiers (Retrofit)

R-406A Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

HCFC Blend Gamma Acceptable This substitute is subject to containment and recovery regulations covering HCFCs.

CFC-12 Non-Automobile Motor Vehicle Air Conditioners (Retrofit and New) HCFC-22 Acceptable HCFC-22 may damage automobile air conditioning systems, which is why it is only acceptable for non-automotive use. This substitute is subject to containment and recovery regulations covering HCFCs.

CFC-13, R-13B1, and R-503 Very Low Temperature Refrigeration (Retrofit and New Equipment / NIKs)

	HFC-23	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
	R-403B	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.
	PFC Blend Alpha	Acceptable	EPA strongly recommends the containment and reclamation of this substitute.

REFRIGERANTS
PENDING DECISIONS

APPLICATION	SUBSTITUTE	COMMENTS
CFC-12 Motor Vehicle Air Conditioning	HCFC Blend Delta	E P A has requested additional data.

HCFC-22 Heat Pumps

	HFC-134a	EPA has not yet evaluated Class II substitutes.
	HFC-152a	E P A has not yet evaluated Class II substitutes.
	HFC-32	E P A has not yet evaluated Class II substitutes.
	R-407A/R-407B	E P A has not yet evaluated Class II substitutes.
HCFC-22 Conventional (Household) Air Conditioning	HFC-125/HFC-134a/HFC-32	E P A has not yet evaluated Class II substitutes.

FOAM SECTOR
ACCEPTABLE SUBSTITUTES

END-USE	SUBSTITUTE	DECISION	COMMENTS
CFC-11			
Rigid Polyurethane and Polyisocyanurate Laminated Boardstock	Electroset Technology	Acceptable	Proprietary technology.
CFC-11			
Polyurethane, Rigid Appliance	Electroset Technology	Acceptable	Proprietary technology.
CFC-11			
Polyurethane, Rigid Commercial	Electroset Technology	Acceptable	Proprietary technology.
CFC-11			
Polyurethane, Rigid Slabstock and Other	Electroset Technology	Acceptable	Proprietary technology.
CFC-12			
Polystyrene, Extruded Boardstock and Billet	HFC-143a	Acceptable	HFC-143a has the highest GWP of those substitutes acceptable for this end-use.
	Electroset Technology	Acceptable	Proprietary technology.
CFC-11, CFC-113			
Phenolic, Insulation Board	Electroset Technology	Acceptable	Proprietary technology.
CFC-11			
Polyurethane, Flexible	Electroset Technology	Acceptable	Proprietary technology.
	Saturated Light Hydrocarbons C3-C6	Acceptable	Flammability may be an issue for the manufacture and transport of products. Hydrocarbons are VOCs and are subject to control under Title I of the Clean Air Act.
CFC-11			
Polyurethane, Integral Skin	Electroset Technology	Acceptable	Proprietary technology.

CFC-12			
Polystyrene, Extruded Sheet	Saturated Light Hydrocarbons C3-C6	Acceptable	Flammability may be an issue for the manufacture and transport of products. Hydrocarbons are VOCs and are subject to control under Title I of the Clean Air Act.
	Electroset Technology	Acceptable	Proprietary technology.
CFC-12, CFC-114, CFC-11			
Polyolefin	Methylene Chloride	Acceptable	Revised OSHA PELs have been proposed at 25 ppm (TWA) for methylene chloride (11/7/91). Subject to meeting all future ambient air controls for hazardous air pollutants under Title III section 112 of the 1990 CAA Amendments. RCRA standards must be met.
	HFC-152a/Saturated Light Hydrocarbons	Acceptable	Flammability may be an issue for the manufacture and transport of products. Major sources of VOC emissions are subject to the New Source Review (NSR) program.
	Chemical Blend A	Acceptable	Proprietary blend.
	Electroset Technology	Acceptable	Proprietary technology.

SOLVENTS
ACCEPTABLE SUBSTITUTES

END-USE	SUBSTITUTE	DECISION	COMMENTS
Metals Cleaning With CFC-113, MCF	Trans-1,2-dichloroethylene	Acceptable	
	Volatile Methyl Siloxanes	Acceptable	Octamethylcyclotetrasiloxanes and decamethylcyclopentasiloxanes are acceptable alternatives. Evaluation of other VMS's is ongoing.
Electronics Cleaning With CFC-113, MCF	Trans-1,2-dichloroethylene	Acceptable	
	Volatile Methyl Siloxanes	Acceptable	Octamethylcyclotetrasiloxanes and decamethylcyclopentasiloxanes are acceptable alternatives. Evaluation of other VMS's is ongoing.
Precision Cleaning With CFC-113, MCF	Trans-1,2-dichloroethylene	Acceptable	
	HCFC-123	Acceptable	New toxicity data has led to an upward revision of the company set workplace exposure limit (AEL) of 30 ppm. The Agency believes that under normal conditions of use, this limit is acceptable.
	Volatile Methyl Siloxanes	Acceptable	Octamethylcyclotetrasiloxanes and decamethylcyclopentasiloxanes are acceptable alternatives. Evaluation of other VMS's is ongoing.

FOAMS

PENDING SUBSTITUTES

END-USE	SUBSTITUTE	COMMENTS
CFC-11, CFC-113		
Rigid Polyurethane, Appliance Foams	Vacuum panels	Agency has not completed review of data.
Polyurethane, Rigid	HFC-356	Insufficient data. Also need information on proposed end-use(s).

SOLVENT CLEANING
PENDING SUBSTITUTES

END-USE	SUBSTITUTE	COMMENTS
Precision Cleaning w/ CFC-113 , MCF	Chlorobromomethane	Agency has not completed review of data.

FIRE SUPPRESSION AND EXPLOSION PROTECTION

ACCEPTABLE SUBSTITUTES: STREAMING AGENTS

APPLICATION	SUBSTITUTE	DECISION	COMMENTS
Halon 1211			
Streaming Agents			
	HCFC-124	Acceptable	This agent is banned in residential applications per section 610(d) of the CAAA.
	[HCFC Blend] C	Acceptable	This agent is banned in residential applications per section 610(d) of the CAAA.
	[HCFC Blend] D	Acceptable	The intended market for this agent is large, outdoor applications. This agent is banned in residential applications per section 610(d) of the CAAA.
	Gelled Halocarbon/Dry Chemical Suspension	Acceptable	This agent was formerly identified as Powdered Aerosol B.

FIRE SUPPRESSION AND EXPLOSION PROTECTION

PENDING SUBSTITUTES

END-USE	SUBSTITUTE	COMMENTS
Halon 1211		
Streaming Agents	HFC-227ea	Complete SNAP submission and personal monitoring data required.

END-USE	SUBSTITUTE	COMMENTS
Halon 1301		
Total Flooding Agents		
	[HFC Blend] A	Agency analysis of this agent is not yet complete.
	[Inert Gas Blend] B	Pending receipt of medical assessment by peer review panel.
	[Inert Gas Blend] C	Pending receipt of medical assessment by peer review panel.
	[Powdered Aerosol] A	For use in occupied areas, pending medical assessment by peer review panel.
	[Water Mist System] A	Pending receipt of medical assessment by peer review panel.
	[Water Mist System] B	Pending receipt of medical assessment by peer review panel.

STERILANTS

ACCEPTABLE

END-USE	SUBSTITUTE	DECISION	CONDITIONS	COMMENTS
12/88 Blend of EtO/CFC-12				
Sterilant	[HCFC Blend] A	Acceptable	This agent has received FIFRA registration.	

STERILANTS

PENDING

END-USE	SUBSTITUTE	COMMENTS
12/88 Blend of EtO/CFC-12		
Sterilant		
	HFC-125	Pending FIFRA registration and completion of Agency review.
	HFC-227ea	Pending FIFRA registration and receipt of complete SNAP submission.

AEROSOLS
ACCEPTABLE SUBSTITUTES

END-USE	SUBSTITUTE	COMMENTS
CFC-11, CFC-113, MCF, HCFC-141b	**as aerosol solvents. Trans-1,2-dichloroethylene**	

AEROSOLS

PENDING

END USE	SUBSTITUTE	COMMENTS
CFC-11, CFC-113, MCF, HCFC-141b as aerosol solvents.	**Monochlorotoluene/benzotrifluorides**	Agency has not completed review. Data submission pending.
CFC-12 as aerosol propellant	**HFC-4310mee**	Agency has not completed review of this data. Premanufacture Notice review under the Toxic Substances Control Act not yet completed.
	Perfluorocarbons (C6F14) and Perfluoropolyethers.	Agency has not completed review. Data submission pending.
	HFC-227	FDA approval still required in metered dose inhalers.

Adhesives, Coatings and Inks
PENDING SUBSTITUTES

END USE	SUBSTITUTE	COMMENTS
Metals cleaning w/ CFC-113, MCF	**Monochloro-toluene/benzo-trifluorides**	Agency has not completed review of data. Evaluation of exposure and toxicity data still ongoing.