ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 82

[FRL–6107–1]

Protection of Stratospheric Ozone; Refrigerant Recycling; Substitute Refrigerants

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: The Environmental Protection Agency (EPA) is proposing to amend the rule on refrigerant recycling promulgated under section 608 of the Clean Air Act to clarify how the requirements of section 608 extend to refrigerants that are used as substitutes for chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC) refrigerants. This proposed rule would supplement a self-effectuating prohibition on venting substitute refrigerants to the atmosphere that became effective on November 15, 1995. It would also exempt certain substitute refrigerants from the prohibition on the basis of current evidence that their release does not pose a threat to the environment. In addition, EPA is proposing to change the current requirements for CFC and HCFC refrigerants to accommodate the proliferation of new refrigerants on the market and to strengthen and clarify the existing leak repair requirements for equipment containing CFC and HCFC refrigerants. This proposed rule will significantly reduce emissions of environmentally harmful refrigerants in a cost-effective manner.

DATES: Written comments on the proposed rule must be received by August 10, 1998, unless a hearing is requested by June 18, 1998. If a hearing is requested, written comments must be received by August 31, 1998. If requested, a public hearing will be held at 10:00 am, July 1, 1998, at 501 3rd St. NW, Washington, DC in the 1st Floor Conference Room. Individuals wishing to request a hearing must contact the Stratospheric Ozone Information Hotline at 1–800–296–1996 by June 18, 1998. To find out whether a hearing will take place, contact the Stratospheric Ozone Information Hotline between June 22, 1998 and July 1, 1998.

ADDRESSES: Comments should be submitted in duplicate to the attention of Air Docket No. A–92–01 VIII.H at: Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460. Additional information may be found at Air Docket No. A–91–42, which is incorporated by reference for purposes of this rulemaking. (Please do *not* submit comments on this proposed rule to A–91–42.) The Air and Radiation Docket and Information Center is located in room M–1500, Waterside Mall (Ground Floor), Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460. Dockets may be inspected from 8 a.m. to 5:30 p.m., Monday through Friday. A reasonable fee may be charged for copying docket materials.

FOR FURTHER INFORMATION CONTACT: Debbie Ottinger, Program Implementation Branch, Stratospheric Protection Division, Office of Atmospheric Programs, Office of Air and Radiation (6205–J), 401 M Street, SW., Washington, DC 20460. The Stratospheric Ozone Information Hotline at 1–800–296–1996 can also be contacted for further information.

SUPPLEMENTARY INFORMATION: The contents of this preamble are listed in the following outline:

I. Regulated Entities

Entities potentially regulated by this action include those who manufacture, own, maintain, service, repair, or dispose of all types of air-conditioning and refrigeration equipment; those who sell or reclaim refrigerants; and manufacturers of refrigerant recycling and recovery equipment. Regulated categories and entities include:

Category	Examples of regulated entities
Industry	Manufacturers of air-conditioning or refrigeration equipment. Technicians who service, maintain, repair, or dispose of air-conditioning and refrigeration equipment. Owners of air-conditioning and refrigeration equipment, including building owners and operators, grocery stores, chemical, pharmaceutical, and petrochemical manufacturers, ice machine operators, utilities. Manufacturers of recycling and recovery equipment. Refrigerant reclaimers. Scrap yards and auto dismantlers.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be regulated by this action. This table lists the types of entities that EPA is now aware could potentially be affected by this action. Other types of entities not listed in the table could also be affected. To determine whether your company is regulated by this action, you should carefully examine the applicability criteria contained in section 608 of the Clean Air Amendments of 1990; discussed in regulations published on December 30, 1993 (58 FR 69638); and discussed below. If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

II. Background

Effective November 15, 1995, section 608(c)(2) of the Clean Air Act prohibits the knowing release of substitutes for CFC and HCFC refrigerants during the maintenance, service, repair, or disposal of air-conditioning and refrigeration equipment, unless EPA determines that such release does not pose a threat to the environment. Although EPA is proposing to determine that releases of some substitute refrigerants do not pose a threat to the environment, there are other substitutes, specifically HFCs and PFCs, for which EPA is not proposing to make such a determination. Thus, EPA is proposing a regulation that will clarify how the venting prohibition of section 608(c)(2) must be implemented for HFC and PFC refrigerants, as well as any other refrigerants whose release EPA does not find does not pose a threat to the environment. EPA is also proposing to strengthen the existing leak repair requirements for some types of appliances containing CFCs and HCFCs, in recognition of design changes that have lowered achievable leak rates.

By establishing requirements regarding the maintenance, service, repair, and disposal of appliances containing HFC and PFC refrigerants, EPA believes that this proposed rule would help to minimize any environmental harm that might result from the transition away from ozone-depleting chemicals. In this respect, this proposed rule is similar to regulations being implemented under sections 609 and 612 of the Act. This rule would directly limit emissions of gases that result in global warming, whose possible consequences are discussed at length in section III.B.2 below. In addition, the proposed rule would reduce emissions of ozone-depleting refrigerants by establishing a consistent regulatory framework for all halocarbon refrigerants and by lowering leak rates for appliances containing ozone-depleting refrigerants. The environmental and human health consequences of ozone depletion include increased rates of skin cancer and cataracts, suppression of the immune system, increased formation of ground-level ozone, damage to crops and other plants, and damage to marine microorganisms at the base of the aquatic food chain. The establishment of a consistent regulatory framework would also facilitate compliance with the Section 608 National Recycling and Emissions Reduction Program by simplifying and clarifying regulatory requirements.

A. Section 608 of the Clean Air Act

Section 608 of the Clean Air Act, as amended in 1990, provides the legal basis for this rulemaking. It requires EPA to establish a comprehensive program to limit emissions of ozone-depleting refrigerants, and prohibits the release of these refrigerants, and eventually their substitutes, during the servicing and disposal of air-conditioning and refrigeration equipment.

Section 608 is divided into three subsections. In brief, the first, section 608(a), requires regulations to reduce the use and emission of class I substances (CFCs, halons, carbon tetrachloride, and methyl chloroform) and class II substances (HCFCs) to the lowest achievable level, and to maximize the recycling of such substances. Section 608(b) requires that the regulations promulgated pursuant to subsection (a) contain requirements concerning the safe disposal of class I and class II substances. Finally, section 608(c) establishes self-effectuating prohibitions on the venting into the environment of class I or class II substances, and eventually their substitutes, during servicing and disposal of air-conditioning or refrigeration equipment.

Specifically, subsection 608(c) provides in paragraph (1) that, effective July 1, 1992, it is ''unlawful for any person, in the course of maintaining, servicing, repairing, or disposing of an appliance or industrial process refrigeration, to knowingly vent or otherwise knowingly release or dispose of any class I or class II substance used as a refrigerant'' in a manner that ''permits such substance to enter the environment.'' The statute exempts from this self-effectuating prohibition ''de minimis releases associated with good faith attempts to recapture and recycle or safely dispose'' of a substance. EPA considers releases to meet the criteria for exempted de minimis releases when they occur while the recycling and recovery requirements of the section 608 and 609 regulations are followed (40 CFR 82.154(a)). Section 608(c)(2) extends the prohibition on venting to substances that are substitutes for class I and class II refrigerants, effective November 15, 1995, unless the Administrator determines that such venting or release does not pose a threat to the environment.

On May 14, 1993, EPA published final regulations implementing subsections (a), (b), and (c)(1) (58 FR 28660). These regulations include evacuation requirements for appliances being serviced or disposed of, standards and testing requirements for recycling and recovery equipment, certification requirements for technicians, purity standards and testing requirements for used refrigerant sold to a new owner, certification requirements for refrigerant reclaimers, leak repair requirements, and requirements for the safe disposal of appliances that enter the waste stream with the charge intact.

EPA is today proposing regulations to implement and clarify the requirements of section 608(c)(2), which extends the prohibition on venting to substitutes for CFC and HCFC refrigerants. EPA believes that these regulations are also important to the Agency's efforts to continue to carry out its mandate under section 608(a) to minimize emissions of ozone-depleting substances. In addition to sections 608 (a) and (c), EPA is relying on its authority under section 301(a) of the Act to promulgate these requirements.

While section 608(c) is self-effectuating, EPA regulations are necessary to define ''(d)e minimis releases associated with good faith attempts to recapture and recycle or safely dispose'' of such substances and to effectively implement and enforce the venting prohibition. EPA believes that these regulations will help to implement the prohibition by providing: (1) Clear guidance to technicians working with substitute refrigerants on what releases do and do not constitute violations of the prohibition, (2) information on the performance of recycling and recovery equipment intended for use with substitute refrigerants through the equipment certification program, and (3) information on how to recycle effectively and efficiently through the technician certification program. Section 301(a) authorizes EPA to ''prescribe such regulations as are necessary to carry out (its) functions under this Act.'' Section 608(c) provides EPA authority to promulgate regulations to interpret, implement and enforce the venting prohibition. Section 301(a) supplements EPA's authority under section 608(c) to promulgate regulations to carry out EPA's functions under section 608(c).

Section 608(a) provides EPA additional authority to promulgate many of the requirements proposed today. Section 608(a) requires EPA to promulgate regulations regarding use and disposal of class I and II substances that ''reduce the use and emission of such substances to the lowest achievable level'' and ''maximize the recapture and recycling of such substances.'' Section 608(a) further provides that ''(s)uch regulations may include requirements to use alternative substances (including substances which are not class I or class II substances) * * * or to promote the use of safe alternatives pursuant to section 612 or any combination of the foregoing.'' As discussed further below, improper handling of substitute substances is likely to produce contamination (and therefore reduction in recycling) and release of class I and class II substances. EPA's authority to promulgate regulations regarding use of class I and II substances, including requirements to use alternatives, is sufficiently broad to include requirements on how to use alternatives, where this is needed to reduce emissions and maximize recycling of class I and II substances.

In particular, certification requirements for technicians who perform work that could release substitute refrigerants to the atmosphere, as enforced through a sales restriction on substitutes, are critical to fulfill the statutory goals for class I and II substances. Technician certification and a sales restriction are necessary to ensure that persons lacking the expertise tested through certification do not release or contaminate class I and II substances in the course of using substitutes to recharge or perform other work on systems containing class I and II substances. In addition, applying one consistent set of requirements to all relevant refrigerants will promote compliance with and enforcement of those requirements for both ozone-depleting refrigerants and their substitutes by reducing complexity and minimizing loopholes.

As discussed below, EPA is proposing requirements very similar to those for CFCs and HCFCs for some alternative refrigerants, while EPA is proposing to exempt other refrigerants from the prohibition on venting because their release or disposal does not pose a threat to the environment.

B. Factors Considered in the Development of this Proposal

In developing these proposed regulations, EPA has considered a number of factors. First, EPA has considered which non-ozone-depleting refrigerants should be classified as ''substitute'' refrigerants. EPA is proposing to adopt a definition that is similar to that adopted by EPA in its Significant New Alternatives Policy (SNAP) Program, except the proposed definition omits the proviso of the SNAP definition that a substitute be ''*intended* for use as a replacement for a class I or class II substance.'' For the purposes of section 608, therefore, EPA proposes to consider a refrigerant a substitute in a certain end-use if the substance is used as a substitute for CFCs or HCFCs in that end-use by any user. That is, EPA would consider a refrigerant a ''substitute'' for CFCs or HCFCs under section 608 if any of the following were the case: (1) The substitute refrigerant immediately replaced a CFC or HCFC in a specific instance, (2) the substitute refrigerant replaced another substitute that replaced a CFC or HCFC in a specific instance (was a second- or later-generation substitute), or (3) the substitute refrigerant had always been used in a particular instance, but other users in that end-use had used it to replace a CFC or HCFC.

EPA does not believe that it is appropriate under section 608 to consider the intent or history of an individual user in determining whether a refrigerant is a ''substitute'' for CFCs or HCFCs in a given instance. First, it is reasonable to interpret ''substitute'' to include second- or later as well as first-generation substitutes for CFCs and HCFCs. As discussed earlier, the goal of these regulations is to minimize any environmental harm that might be associated with the transition away from CFC and HCFC refrigerants. In many cases, the transition away from CFCs and HCFCs is a multi-step process, with substitutes supplanting each other as they are tested and developed. In the absence of the phaseout of CFCs and HCFCs, the later-generation substitutes would probably never have been used. Thus, even if a substance is not being used as a direct substitute for CFCs or HCFCs in a particular instance, its use is the result of the transition away from CFCs and HCFCs and the substance serves as a substitute for these chemicals. (Of course, the environmental impact of the release of the chemical is the same regardless of what it replaces.)

Second, it is also reasonable to interpret ''substitute'' to mean a refrigerant that is occasionally used as a substitute for CFC or HCFC refrigerants in a given end-use (e.g., cold storage warehouses), even if the refrigerant has always been used by a particular user or in a particular end-use. EPA has broad authority to promulgate and implement clear, enforceable regulations, and exercise of this authority would be impeded if the Agency had to attempt to trace the individual histories of specific appliances in implementing and enforcing the requirements. As an example of how this definition would work under these regulations, ammonia used in cold storage warehouses would be considered a ''substitute,'' and would therefore be subject to section 608(c)(2),[1]

[1] As discussed below, ammonia may nevertheless be exempted from these regulations because EPA is

because at least some cold storage warehouses have substituted ammonia for CFCs. This would be true even if the ammonia in a given cold storage warehouse were the original refrigerant at that particular site, or if another substitute had first replaced the original CFC refrigerant and ammonia in turn had replaced that substitute.

Using this criterion, EPA has identified five classes of substitute refrigerants in the sectors covered by the SNAP rule: hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), hydrocarbons (HCs), chemically active common gases, including ammonia and chlorine, and inert atmospheric constituents, including carbon dioxide and water. EPA has divided substitutes into these classes on the basis of the varying environmental impacts of each class and the varying regulatory structures already in place for each class.

As the second factor in this proposed rulemaking, EPA has made a proposed determination regarding whether or not the release or disposal of a substitute refrigerant during the service or disposal of an appliance poses a threat to the environment. This determination consists of two findings. In the first finding, EPA determines whether release or disposal of a substitute refrigerant could pose a threat to the environment due to the toxicity or other inherent characteristic of the refrigerant. In the second finding, EPA determines whether and to what extent such release or disposal actually takes place during the servicing and disposal of appliances. The release and disposal of many substitute refrigerants are limited and/or controlled by other authorities, such as OSHA regulations and building codes. To the extent that release during the servicing and disposal of appliances is adequately controlled by other authorities, EPA proposes to defer to these authorities rather than set up a second regulatory regime.

As is discussed in more detail below, EPA recognizes that release of HFCs and PFCs during the servicing and disposal of appliances could pose a threat to the environment due to the global warming potential (GWP) of these refrigerants, that release of hydrocarbons during the servicing and disposal of appliances could pose a threat due to the flammability and smog-forming capability of these refrigerants, and that release of chemically active common gases during the servicing and disposal of appliances could pose a threat due to the toxicity and flammability of these refrigerants. However, EPA is proposing to determine that the release of hydrocarbons and chemically active common gases during the servicing and disposal of appliances is adequately controlled by other authorities, and therefore does not actually pose a threat. EPA is also proposing to determine that the release of inert atmospheric constituents during the servicing and disposal of appliances does not pose a threat to the environment.

As the third factor in this proposed rulemaking, EPA has considered the availability of technology to control releases, the environmental benefits of controlling releases, and the costs of controlling releases for each class of substitutes. (In proposing new permissible leak rates for certain CFC and HCFC appliances, EPA has considered these factors for CFCs and HCFCs.) In addition, as much as possible, EPA has sought to maintain consistency between the proposed requirements for HFCs and those for CFCs and HCFCs. The Agency considers such consistency important for two reasons. First, it will reduce confusion, simplify the regulatory scheme, and ease compliance both with the requirements applying to substitutes and with those applying to CFCs and HCFCs. Second and more important, the Agency believes that much of the rationale for the recycling program developed for ozone-depleting refrigerants applies to any recycling program for environmentally harmful refrigerants.

C. Public Participation

In developing this proposed rule, EPA has also considered comments received during meetings with industry, government, and environmental representatives. On March 10, 1995, EPA convened a meeting with 20 representatives of appliance manufacturers, servicers, and users, recycling and recovery equipment manufacturers, equipment testers, and refrigerant reclaimers and wholesalers, soliciting comment on a range of regulatory options. A summary of this meeting is available in the public docket for this rulemaking. EPA has also met with industry and government representatives to gather data on refrigerant emissions, to better understand current industry practices, and to determine when and how existing regulatory authorities control emissions of substitute refrigerants. Finally, EPA has worked with the air-conditioning and refrigeration industry's primary standards-setting organizations, the Air Conditioning and Refrigeration Institute (ARI) and the American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc. (ASHRAE), in developing its proposal. Wherever appropriate, EPA has incorporated standards and guidelines from these organizations into the proposed rule.

III. Scope of Statutory and Proposed Regulatory Requirements

A. Overview of Proposed Requirements

1. HFCs and PFCs

EPA is proposing to extend the regulatory framework for CFCs and HCFCs to HFCs and PFCs, making appropriate adjustments for the varying physical properties and environmental impacts of these refrigerants. Thus, appliances containing HFC or PFC refrigerants would have to be evacuated to established levels; recycling and recovery equipment used with HFCs or PFCs would have to be certified (although existing recovery equipment that met certain minimum standards would be grandfathered); technicians who work with HFCs or PFCs would have to be certified (although technicians who have been certified to work with CFCs and HCFCs would be grandfathered); sales of HFC and PFC refrigerants would be restricted to certified technicians; used HFC and PFC refrigerants sold to a new owner would have to be tested to verify that they meet industry purity standards; refrigerant reclaimers who purify HFCs or PFCs would have to be certified; owners of HFC and PFC appliances above a certain size would have to repair leaks above a certain size; final disposers of small appliances and motor vehicle air conditioners (MVACs) containing HFCs or PFCs would have to ensure that refrigerant was recovered from this equipment before it was disposed of; and manufacturers of HFC and PFC appliances would have to provide a servicing aperture or a ''process stub'' on their equipment in order to facilitate recovery of the refrigerant.

2. Chemically Active Common Gases

EPA is proposing to find that for the purposes of section 608, the release and disposal of chlorine and ammonia do not pose a threat to the environment because the release and disposal of these refrigerants during the servicing and disposal of appliances are adequately controlled by other authorities in the air-conditioning and refrigeration applications where these refrigerants are currently used. Therefore, EPA is proposing to find that the venting prohibition does not apply to these substances and the Agency is not proposing recycling requirements for these refrigerants at this time.

proposing to determine that it is adequately controlled under other authorities.

However, these proposed findings apply to currently SNAP-identified end uses only. If ammonia and chlorine are proposed for use in other applications, EPA will evaluate whether the venting prohibition and recycling requirements should apply in those applications.

3. Hydrocarbons

EPA is proposing to find that for the purposes of section 608, the release and disposal of hydrocarbons during the servicing and disposal of appliances do not pose a threat to the environment, because they are adequately controlled by other authorities in the industrial process refrigeration applications in which these refrigerants are currently used. Therefore, EPA is proposing to find that the venting prohibition does not apply to these substances and the Agency is not proposing recycling requirements for these refrigerants at this time. However, these proposed findings apply to currently SNAP-identified end uses only. If hydrocarbons are proposed for use in other applications, EPA will evaluate whether the venting prohibition and recycling requirements should apply in those applications.

4. Proposed Changes to Requirements for CFCs and HCFCs

In today's document, EPA is also proposing a number of changes to the regulations covering CFC and HCFC refrigerants. Several of these proposed changes are intended to accommodate the growing number of refrigerants (both HFCs and HCFCs) that either are or will be subject to the regulations. Such changes include the adoption of evacuation requirements based solely on the saturation pressures of refrigerants, the use of representative refrigerants from saturation pressure categories for certifying recycling and recovery equipment, and the adoption of the most recent industry purity and analytical standard for refrigerants, ARI 700–1995, which includes a number of refrigerants omitted from its predecessor, ARI 700–1993.

Based on improvements in equipment design and maintenance that have reduced leak rates over the last five years, EPA is also proposing to reduce the maximum allowable leak rates for appliances containing more than 50 pounds of refrigerant. At the same time, EPA is proposing to make several changes to the leak repair requirements promulgated at § 82.156(i), the associated recordkeeping provisions at § 82.166(n) and (o), and the definition of ''full charge'' at § 82.152. EPA is also proposing to add a definition for ''leak rate'' under § 82.152 for the purposes of § 82.156(i). The need for most of these proposed changes was brought to EPA's attention by industry stakeholders. EPA is also responding to inquiries concerning whether or not leaks that occur after repairs have been completed and all applicable verification tests have been successfully performed are considered new leaks. In addition, the stakeholders suggested several clarifying changes to the recordkeeping provisions.

B. Determination of Whether Release or Disposal Poses a Threat to the Environment

1. Methodology

In determining whether the release or disposal of a substitute refrigerant during the servicing and disposal of appliances poses a threat to the environment, EPA has examined the potential effects of the refrigerant from the moment of release to its breakdown in the environment, considering possible impacts on workers, building occupants, and the environment as a whole. As noted above, these effects vary among the different classes of refrigerant. EPA has also examined the extent to which the release or disposal of a substitute is already controlled by other authorities. In some cases, such authorities tightly limit the quantity of the substitute emitted or disposed of; in others, they ensure that the substitute is disposed of in a way that will limit its impact on human health and the environment. In still others, existing authorities address some threats (e.g., occupational exposures) but not others (e.g., long-term environmental impacts). The analysis below discusses the potential environmental impacts of and existing controls on each class of refrigerants.

2. HFCs and PFCs

a. *Potential Environmental Impacts*

i. Toxicity and Flammability

Most HFCs and PFCs have been classified as A1 refrigerants under ASHRAE Standard 34, indicating that they have low toxicity and no ability to propagate flame under the test conditions of the Standard. (The exception is HFC 152a, which has been classified as an A2 refrigerant. This indicates that it may propagate flame under the test conditions, but only at relatively high concentrations and with relatively low heat of combustion.) However, like CFCs and HCFCs, HFCs can have central nervous system depressant and cardiotoxic effects at high concentrations (several thousand ppm) and can displace oxygen at very high concentrations.

ii. Long-term Environmental Impacts

Once released into the atmosphere, hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) have the ability to trap heat that would otherwise be re-radiated from the Earth back to space. This ability, along with the relatively long atmospheric lifetime of these gases (particularly the PFCs), gives both HFCs and PFCs relatively high global warming potentials (GWPs). The GWP of a gas is a measure of the ability of a kilogram of that gas to contribute to global warming compared to the ability of a kilogram of carbon dioxide to contribute to global warming over a given span of time. The 100-year GWPs of HFCs under consideration for use as refrigerants range from 140 (for HFC–152a) to 11,700 (for HFC–23), and the GWPs of PFCs under consideration for use as refrigerants range from 8,700 (perfluorocyclo-butane) to 9,200 (perfluoroethane). HFC 134a, the most common individual HFC used in air-conditioning and refrigeration equipment, has a global warming potential of 1,300. Thus, the global warming impact of releasing a kilogram of an HFC or PFC ranges from 140 to 11,700 times the impact of releasing a kilogram of CO_2.[2] (Factoring in the 35% uncertainty associated with individual GWPs, this range becomes 90 to 15,800.)

EPA recognizes that the release of refrigerants with high global warming potentials could pose a threat to the environment. Internationally accepted science indicates that increasing concentrations of greenhouse gases, including HFCs and PFCs, will ultimately raise atmospheric and oceanic temperatures. Although the precise timing and extent of likely warming are uncertain, the Intergovernmental Panel on Climate Change (IPCC)[3] concluded in a 1995

[2] The CFCs and HCFCs being replaced by the HFCs are also greenhouse gases, though their direct warming effect is counteracted somewhat by the indirect cooling effect caused by their destruction of stratospheric ozone, which is itself a greenhouse gas. The IPCC Second Assessment noted that ''The net GWPs for the ozone-depleting gases, which include the direct ''warming'' and indirect ''cooling'' effects, have now been estimated.* * * The indirect effect reduces their net GWPs: those of the chlorofluorocarbons tend to be positive, while those of the halons tend to be negative'' (IPCC Second Assessment, Working Group I report, p. 73).

[3] The IPCC was jointly established by the World Meteorological Organization and the United Nations Environment Programme in 1988 to assess the scientific information that is related to the various components of the climate change issue, and to formulate realistic response strategies for the management of the climate change issue. The first IPCC report was developed by 170 scientists from

Report that the global mean temperature would probably rise between 1 and 3.5°C by 2100. Such a temperature rise would probably be associated with a number of adverse environmental impacts, including increased drought at middle latitudes, increased flood frequency and inundation due to sea level rise, and forest and species loss due to the rapid poleward migration of ideal ranges.

It is already well established that naturally occurring greenhouse gases keep the Earth 33°C warmer than it otherwise would be. Since 1800, human activities have released additional greenhouse gases to the atmosphere at an exponentially increasing rate. Atmospheric concentrations of carbon dioxide have risen by approximately 30 percent; methane concentrations have risen by 145 percent; and nitrous oxide concentrations have risen by 15 percent. In addition, concentrations of man-made fluorocarbons, which have no natural source, have risen quickly over the past 50 years.

These trends may have already had an influence on global climate. The draft of the most recent report of the IPCC stated that ''emerging evidence points towards a detectable human influence on climate.'' In support of this statement, the draft report notes that the global mean surface temperature has increased by between about 0.3 and 0.6°C since the late 19th century, that the 20th century global mean temperature is at least as high as that of any other century since 1400 A.D. (before which data are too sparse to allow reliable estimates), that the years since 1990 have been some of the warmest in the instrumental record (the nine warmest years this century have all occurred since 1980), and that sea levels around the world have risen by between 10 and 25 centimeters over the past 100 years. Moreover, several other events consistent with global warming have been observed, including a decrease in Northern Hemisphere snow cover, a simultaneous decrease in Arctic sea ice, and continued melting of alpine glaciers. The report concludes:

> Observed global warming over the past 100 years is larger than our best estimates of the magnitude of natural climate variability over at least the last 600 years. More importantly, there is evidence of an emerging pattern of climate response in the observed climate record to forcings by greenhouse gases and sulphate aerosols. The evidence comes from the geographical, seasonal and vertical patterns of temperature change. Taken together, these results point towards a detectable human influence on global climate.

Because of the large thermal inertia of Earth's climate system (including the atmosphere and the oceans), the full effects of added greenhouse gases are not likely to be felt until many decades after their release into the atmosphere. Once these effects are felt, reversing them will take centuries. Thus, policy decisions in the near term have long-term consequences.

Global warming is expected to have far-reaching effects both domestically and internationally. Changes in precipitation and increased evaporation from higher temperatures could affect water supplies and water quality, posing threats to hydropower, irrigation, fisheries, and drinking water. In the U.S., floods and droughts will probably occur more often because of an intensification of the hydrologic cycle.

The IPCC report projects that sea level will rise by about 50 cm by 2100, using a mid-range emissions scenario and best-estimate values of climate sensitivity and ice-melt sensitivity to warming. Such a rise could inundate more than 5,000 square miles of land in the U.S. if no protective actions are taken. Low-lying areas on the U.S. Atlantic and Gulf coasts are especially at risk. Internationally, parts of many low-lying areas such as parts of the Maldives, Egypt, and Bangladesh could be completely inundated and made uninhabitable by a similar sea level rise.

Climate change could also have direct impacts on human health. Global warming may shift the range of infectious diseases, increasing the risks of malaria and dengue fever in the United States. Changing temperatures and precipitation patterns may produce new breeding sites for pests and pathogens. In addition, climate change is likely to increase deaths from heat stress.

Agriculture would also be affected, as large areas of the eastern and central U.S. are expected to become drier as the earth warms. Although changes in management practices and technological advances might reduce many of the potentially negative effects of climate change in agriculture, such changes would be expensive. Agricultural production in developing countries is likely to be more vulnerable to climate change, given that they have fewer economic resources.

Finally, climate change could profoundly affect natural habitats and wildlife. Temperature changes of the magnitude expected from the enhanced greenhouse effect have occurred in the past, but the previous changes took place over centuries or millennia, whereas those expected from increased greenhouse gases will take place over decades. For example, the ideal range for some North American forest species may shift as much as 300 miles to the north over the next several decades. Rates of natural migration and adaptation of species and communities appear to be much slower than the predicted rate of climate change. As a result, populations of many species and inhabited ranges could change as the climate to which they are adapted effectively shifts northward or to higher elevations.

b. *Current Practices and Controls*

Under the SNAP program, HFCs (either pure or in blends) have been approved for use in almost every major air-conditioning and refrigeration end-use, including household refrigerators, motor vehicle air conditioners, retail food refrigeration, comfort cooling chillers, industrial process refrigeration, and refrigerated transport. HFC 134a in particular has claimed a large share of the market for non-ozone-depleting substitutes in these applications. Given this range of applications, HFCs have the potential to come into contact with consumers, workers, the general population, and the environment.

EPA has approved PFCs for use in relatively few end-uses because of their large global warming potentials and long atmospheric lifetimes. These end-uses include uranium isotope separation, for which no other substitute refrigerant has been found, and some heat-transfer applications. In these applications, PFCs may come into contact with workers, the general population, and the environment.

Analyses performed for both this rule and the SNAP rule indicate that existing regulatory requirements and industry practices are likely to keep the exposure of consumers, workers, and the general population to HFCs and PFCs below levels of concern (although recycling requirements would reduce still further the probability of significant exposure) (U.S. EPA. 1994. *Risk Screen on the Use of Substitutes for Class I Ozone-Depleting Substances: Refrigeration and Air Conditioning, Office of Air and Radiation, March 15, 1994. Office of Air and Radiation, March 15,1994, and Regulatory Impact Analysis for the Substitutes Recycling Rule*, Office of Air and Radiation, 1998). However, these requirements and practices do not

25 countries and was peer-reviewed by an additional 200 scientists. Since that time, the number of scientists developing and reviewing the report has grown. This group comprises most of the active scientists working in the field in the world today, and therefore the report is an authoritative statement of the views of the international scientific community at this time.

address release of HFCs or PFCs to the wider environment.

For example, ASHRAE Standard 15 [4] requirements for equipment with large charge sizes are likely to limit the exposure of building occupants and workers to HFC and PFC refrigerants, but will not necessarily reduce releases to the outdoors. Under ASHRAE 15, equipment containing large charges of HFCs or PFCs (or HCFCs or CFCs) must be located in a machinery room that meets certain requirements. These include requirements for tight-fitting, outward-opening doors, refrigerant detectors that actuate alarms when refrigerant levels rise above recommended long-term exposure levels, and mechanical ventilation that discharges to the outdoors. However, ASHRAE 15 does not include requirements for refrigerant recycling.[5] In general, ASHRAE 15 addresses design specifications rather than service and disposal practices such as recycling, and ASHRAE 15 requirements are codified and enforced by state or local building code agencies rather than by contractor or technician licensing boards.

Similarly, the American Industrial Hygiene Association (AIHA) has developed exposure limits for HFCs. These may be referenced by OSHA under its general duty clause to compel employers to protect employees from identified health hazards. However, local exhaust ventilation rather than recycling may be used to minimize exposures during service and disposal operations that involve significant releases of refrigerant. This will reduce worker exposure to the refrigerant, but will not reduce the exposure of the general environment.

Finally, many of the statutory and regulatory mechanisms that limit release of other substitutes such as ammonia do not apply to HFCs or PFCs. HFCs and PFCs are not listed chemicals for SARA Title III or CERCLA reporting requirements; nor are they listed as EPA section 112(r) hazardous air pollutants.

c. *Conclusion*

Given the high global warming potentials of HFCs and PFCs and the fact that no authority other than section 608(c)(2) currently controls their release from appliances into the environment, EPA is not proposing to find that the release of HFCs and PFCs does not pose a threat to the environment.[6]

EPA's consideration of global warming potential in determining whether to exempt refrigerants from the venting prohibition of 608(c)(2) is supported by precedent under the Title VI regulatory program, Presidential directive, and the legislative history of section 608. First, EPA has specifically considered the global warming potential of substitutes in determining whether they are acceptable for various end uses under the Significant New Alternatives Program (SNAP) that implements section 612.[7] As stated in the final SNAP rule (59 FR 13049, March 18, 1994), EPA believes that ''overall risk'' includes global warming potential. Second, in October 1993, the President directed EPA through the Climate Change Action Plan (CCAP) to work with manufacturers, sellers, and users of PFCs and HFCs to minimize emissions of these substances.

Third, the legislative history of section 608(c)(2) indicates that Congress specifically intended that EPA consider the global warming potential of substitute refrigerants in determining whether to exempt them from the venting prohibition. In a statement read into the record shortly before passage of the Clean Air Act Amendments of 1990, Senators Chafee and Baucus, the Senate managers of the bill, stated that ''(section 608(c)(2)) is an important provision because many of the substitutes being developed * * * are 'greenhouse gases' and have radiative properties that are expected to exacerbate the problem of global climate change.'' The Senators specifically directed that ''(t)he Administrator shall consider long term threats, such as global warming, as well as acute threats (in making the determination under 608(c)(2))'' (Cong. Rec. S 16948 (Oct. 27, 1990)). EPA believes that in light of this legislative history, the precedents cited above, and the expected effects of global warming, it would be very difficult to justify exempting HFCs or PFCs from the venting prohibition of paragraph 608(c)(2) on the basis that their release does not pose a threat to the environment.

3. *Chemically Active Common Gases*

The two chemically active common gases used as refrigerants are ammonia and chlorine.

a. *Potential Environmental Impacts*

i. Toxicity and Flammability

Ammonia can pose a human health hazard through either inhalation or ingestion. It is irritating at relatively low concentrations, and disabling (and possibly deadly) at higher concentrations. Ammonia can also pose a hazard to aquatic organisms if it is discharged to surface waters at high concentrations.

Ammonia is classified as a B2 refrigerant under ASHRAE 34, indicating that it is toxic at relatively low concentrations and flammable at relatively high concentrations. Toxicity reference values that have been established for ammonia include a Permissible Exposure Limit (PEL) of 50 ppm, a Threshold-Limit Value (TLV) and a Recommended Exposure Limit (REL) of 25 ppm, a Short-term Exposure Limit (STEL) of 35 ppm, and an Immediately Dangerous to Life and Health (IDLH) value of 500 ppm.[8]

Chlorine gas is highly toxic. Inhalation of chlorine gas at high concentrations can cause pulmonary edema, cardiac arrest, and inflammation of the larynx. Exposure to concentrations of chlorine below 5 ppm can irritate mucous membranes, the respiratory tract, and skin, and can cause headaches, nausea, blister formation, vomiting and reduced pulmonary function. Toxicity Reference Values that have been established for chlorine gas include a PEL of 1 ppm, a TLV of 0.5 ppm, a STEL of 1 ppm, and an IDLH of 30 ppm. ASHRAE 34 has not classified chlorine.

Chlorine is non-combustible in air, but most combustible materials will burn in chlorine as they do in oxygen.

ii. Long-Term Environmental Impacts

Ammonia is a naturally occurring compound, and is a central compound in the environmental cycling of nitrogen. In surface water, groundwater, or sediment, ammonia will undergo sequential transformation by two

[4] ASHRAE 15, Safety Code for Mechanical Refrigeration, is an industry standard developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers. ASHRAE 15 forms the basis for state and local building codes throughout the U.S.

[5] ASHRAE Guideline 3 recommends recycling of all fluorocarbon refrigerants, but is not codified or enforced by any governmental agency.

[6] In 1995, a modeling study indicated that trifluoroacetic acid (TFA), a breakdown product of HFC 134a, might accumulate and concentrate in urban wetlands with high evaporation rates. EPA is monitoring the research in this area. To the extent that TFA formation and concentration pose a threat to the environment, recycling requirements for HFC 134a will address this threat as well as the threat from global warming related to HFC 134a.

[7] Note that a finding under section 612 that a substitute is acceptable for use in a closed refrigeration system is different from a finding under section 608(c)(2) that the release of that substitute does not pose a threat to the environment. Thus, substances that have been approved under SNAP for use as refrigerants may nevertheless be subject to the venting prohibition of 608(c)(2).

[8] PELs are established by OSHA, TLVs and STELs by the American Congress of Governmental Industrial Hygienists, and RELs and IDLHs by the National Institute of Occupational Safety and Health (NIOSH). PELs and TLVs are 8=hour time-weighted averages (TWAs).

processes in the nitrogen cycle, nitrification and denitrification, eventually leading to the production of elemental nitrogen.

Ammonia can also undergo volatilization or ionization. If released to surface water, ammonia may volatilize to the atmosphere. The rate of volatilization decreases as pH and temperature decrease. The toxicity of ammonia to aquatic organisms (fish are especially vulnerable) also decreases with pH. In addition to its direct effects, ammonia can indirectly cause in-stream toxicity through its contribution to eutrophication and its effect on biological oxygen demand.

Because chlorine used as a refrigerant is typically recaptured or chemically transformed rather than released, its environmental fate will not be discussed here.

Ammonia and chlorine have GWPs of 0.

b. *Current Practices and Controls*

When refrigeration technology was first developed, ammonia was one of the first refrigerants to gain acceptance. It is now used almost exclusively in industrial process refrigeration systems in the meat packing, dairy, frozen juice, brewery, cold storage, and other food industries. In these applications, ammonia may come into contact with workers, the general population, and the environment. (Ammonia is also used with water in small absorption refrigeration units. However, while ammonia could conceivably come into contact with consumers in this application, these exposures are likely to be of little concern because the charge is small and is mixed with water, limiting release to the air.) Additional exposures to ammonia may occur from its use in non-refrigerant applications, such as fertilizer and common household cleaner, but these exposures will not be discussed here except as a context for refrigerant-related exposures.

Due to its high toxicity, chlorine has not been submitted or approved for use as a refrigerant except in industrial processes involved in chlorine manufacture. In this application, chlorine could come into contact with workers, the general population, and the environment.

Analyses performed for both this rule and the SNAP rule (*RIA* and *Risk Screen*) indicate that regulatory requirements and industry practices are likely to keep the exposure of workers, the general population, and the environment to ammonia and chlorine below levels of concern.

Occupational exposure to ammonia is primarily controlled by OSHA requirements and national and local building and fire codes. As mentioned above, OSHA has established a PEL for ammonia of 50 ppm. This is an enforceable standard that can be met through containment, safe disposal, ventilation, and/or use of personal protective equipment. OSHA also has requirements in place to prevent catastrophic releases, including the Hazardous Waste Operations and Emergency Response Standard (HAZWOPER), the Hazard Communication Standard, and Process Safety Management (PSM) regulations. (PSM regulations cover systems containing more than 10,000 pounds of ammonia.) These standards require employee training, emergency response plans, and written standard operating procedures.

ASHRAE 15 (and state and local codes based on it) imposes strict quantity limits for direct-type ammonia refrigeration systems (which possess no secondary, heat transfer fluid), and prohibits the use of ammonia altogether in direct-type comfort cooling systems. Indirect type ammonia refrigeration and air-conditioning systems (which possess a secondary, heat transfer fluid) must be housed in a separate mechanical equipment room. This equipment room must meet the requirements listed above for HFC equipment rooms and must also meet several fire-proofing requirements.

Releases of ammonia to the wider environment are addressed by several authorities. CERCLA and SARA require reporting of accidental and intentional releases of ammonia to the atmosphere. (Under CERCLA section 103 and SARA Title III Section 304, releases of more than 100 pounds of ammonia must be reported immediately, unless they are ''Federally permitted'' such as through National Pollutant Discharge Elimination System (NPDES), State Implementation Plans (SIPs), etc. In that case, however, they are controlled under the permitting authority.

The more common method of ammonia disposal is to mix the ammonia into water, which absorbs about a pound of ammonia per gallon of water, and then to dispose of the water/ammonia solution. Releases of ammonia to surface waters are governed by permits issued by states (or, in some cases, by EPA Regional Offices) to publicly owned treatment works (POTWs) under NPDES. NPDES permits must include conditions necessary to meet applicable technology-based standards and water quality standards. Water quality standards established by states consist of a designated use for the waters in question, water quality criteria specifying the amount of various pollutants that may be present in those waters and still allow the waters to meet the designated use, and anti-degradation policies.

Entities that discharge to a POTW (usually through a municipally-owned sewer system) must themselves comply with Clean Water Act pre-treatment requirements, which may include categorical pretreatment standards on an industry-by-industry basis as well as local limits designed to prevent interference with the biological processes of the treatment plant (or pass through of pollutants). Notification and approval requirements enable POTWs to manage the treatment process, to avoid ammonia overloading, and to protect the treatment processes, collection systems, and facility workers. The POTW typically considers a number of factors before granting discharge approval for ammonia, including the POTW plant's treatment capacity, existing industry discharge patterns, the impact on the POTW's biological treatment processes, the effect on the sewage collection systems (i.e., sewer lines), and the possible hazards to workers at the plant or in the field. The POTW also considers the possibility that ammonia disposed from refrigeration systems may largely be converted to other forms of nitrogen (e.g., nitrates) before arriving at the POTW facility. In general, ammonia from refrigerant uses makes up a small percentage of the ammonia treated by the POTW.

Ammonia is also listed as a regulated substance for accidental release prevention in the List of Substances and Thresholds rule (59 FR 4478, January 31, 1994) promulgated under section 112(r) of the Act. This rule states that if a stationary source handles more than 10,000 pounds of anhydrous ammonia (or 20,000 pounds of 20% or greater aqueous ammonia) in a process, it is subject to chemical accident prevention regulations promulgated under section 112(r). These regulations, which were published on June 20, 1996 (61 FR 31668), require stationary sources to develop and implement a risk management program that includes a hazard assessment, an accident prevention program (including training and the development of standard operating procedures), and an emergency response program. In addition, section 112(r)(1) of the Act states that companies have a general duty to prevent accidental releases of extremely hazardous substances, including ammonia and chlorine.

Exposures to chlorine are controlled through many of the same regulatory mechanisms that control exposures to ammonia, except enforceable concentration and release limits are lower for chlorine than for ammonia. For instance, the OSHA PEL for chlorine is 1 ppm, compared to 50 ppm for ammonia. Similarly, the reporting threshold under CERCLA section 103 and SARA Title III for chlorine releases is ten pounds, compared to 100 pounds for ammonia; and the quantity of chlorine that triggers requirements under section 112(r) of the Clean Air Act is 2,500 pounds per process.

In addition to these requirements, chlorine is also subject to restrictions under section 112(b) and 113 of the Clean Air Act (CAA). Chlorine is listed as a Hazardous Air Pollutant (HAP) under section 112(b) of the CAA, and under section 113 of the CAA, criminal penalties can be assessed for negligently releasing HAPs into the atmosphere.

EPA is currently investigating whether there are any chlorine sources that are ''major sources'' under CAA section 112(a). A ''major'' source is one that releases more than 10 tons per year of any given HAP, or 25 tons per year or more of any combination of HAPs. Such sources would be regulated under a National Emissions Standard for Hazardous Air Pollutants (NESHAP). Because chlorine emissions are currently well controlled during chlorine manufacture, no manufacturer emits more than 10 tons per year of chlorine.

Current industry practices and engineering controls in chlorine manufacture will be applied to the use of chlorine as a refrigerant, minimizing potential releases and exposures. These practices and controls include use of system alarms that activate at chlorine concentrations of 1 ppm, use of self-contained breathing apparatus during servicing, isolation of liquid chlorine in receivers during servicing, and use of a caustic scrubber to neutralize gaseous chlorine during servicing. The anticipated charge sizes in the refrigeration system are several hundred times smaller than the quantity of chlorine in the process stream and bulk storage, and chlorine emissions from the refrigeration system are likely to be significantly smaller than those emanating from the process and storage systems, which are already well controlled for safety and health reasons.

c. *Conclusion*

Because releases of ammonia and chlorine from their currently approved refrigeration applications are adequately addressed by other authorities, EPA is proposing to find that the release of ammonia and chlorine refrigerants during the servicing and disposal of appliances in these applications does not pose a threat to the environment under section 608. EPA requests comment on this proposed finding and on the rationale behind it.

4. Hydrocarbons

a. *Potential Environmental Impacts*

i. Toxicity and Flammability

Hydrocarbons, including propane, propylene, and butane, are classified as A3 refrigerants by ASHRAE Standard 34, indicating that they have low toxicity and high flammability. Like CFCs, HCFCs, and HFCs, they can displace oxygen at high concentrations and cause asphyxiation. Toxicity reference values that have been established for hydrocarbons include a PEL for propane of 1,000 ppm, and IDLHs of 20,000 ppm and 50,000 ppm for propane and butane respectively.

ii. Long-Term Environmental Impacts

Hydrocarbons are volatile organic compounds (VOCs) and therefore contribute to ground-level ozone (smog) formation. Because ozone is a greenhouse gas, hydrocarbons contribute slightly and indirectly to global warming. They do not deplete stratospheric ozone.

b. *Current Practices and Controls*

EPA has approved hydrocarbons under the SNAP program only for use in industrial process refrigeration systems used for hydrocarbon manufacture. In this application, hydrocarbons have the potential to come into contact with workers, the general population, and the environment. However, analyses performed for both this rule and the SNAP rule indicate that existing regulatory requirements and industry practices adequately protect workers, the general population, and the environment from exposure to hydrocarbon refrigerants.

As is the case for ammonia and chlorine, occupational exposures to hydrocarbons are primarily controlled by OSHA requirements and national and local building and fire codes. As noted above, OSHA has established a PEL for propane of 1,000 ppm, and NIOSH has established IDLHs of 20,000 ppm and 50,000 ppm for propane and butane respectively. The PEL is an enforceable standard, and the IDLHs trigger OSHA personal protective equipment requirements. OSHA's Process Safety Management, confined space entry, and HAZWOPER requirements apply to all hydrocarbon refrigerants. These requirements include employee training, emergency response plans, air monitoring, and written standard operating procedures.

ASHRAE 15 prohibits the use of hydrocarbon refrigerants except in laboratory and industrial process refrigeration applications. Refrigeration machinery must be contained in a separate mechanical equipment room that complies with the requirements for HFC equipment rooms and also complies with several fire-proofing requirements.

As is the case for ammonia and chlorine, certain hydrocarbons (including butane, cyclopropane, ethane, isobutane, methane, and propane) are listed as regulated substances for accidental release prevention under regulations promulgated under section 112(r) of the Clean Air Act. In addition, hydrocarbons are considered VOCs, and are therefore subject to state VOC regulations implemented in accordance with the Clean Air Act. The regulatory status of new VOC sources is based on area ground-level ozone classifications. Although states and industry have various options regarding the permitting of new VOC sources, industry typically must implement technologies that provide lowest achievable emissions rates, and must offset new VOC contributions through reductions in existing sources.

According to industry and OSHA representatives, current industry service practices for hydrocarbon refrigeration equipment include monitoring efforts, engineering controls, and operating procedures. System alarms, flame detectors, and fire sprinklers are used to protect process and storage areas. Fugitive emissions monitoring is routinely conducted. If a leak is found, repairs are attempted within five days. If initial repair attempts are unsuccessful, the system is shut down, unless releases from a shutdown are predicted to be greater than allowing a continued leak. During servicing, OSHA confined space requirements are followed, including continuous monitoring of explosive gas concentrations and oxygen levels. Hydrocarbon refrigerants may be returned to the product stream or can be released through a flare during servicing. Due to fire and explosion risks and the economic value of the hydrocarbon, direct venting is not a widely used procedure. In general, hydrocarbon emissions from refrigeration systems are likely to be significantly smaller than those emanating from the process and storage systems, which are already well-controlled for safety reasons.

c. *Conclusion*

Because the release of hydrocarbons from industrial process refrigeration systems appears to be adequately addressed by other authorities, EPA is proposing to find that the release of hydrocarbon refrigerants during the servicing and disposal of such systems does not pose a threat to the environment under section 608. EPA requests comment on this proposed finding and on the rationale behind it.

5. Inert Atmospheric Constituents

EPA has approved CO_2 under SNAP as a replacement for CFC-13, R-13B1 and R-503 in very low temperature and industrial process refrigeration applications, and as a substitute for CFC-113, CFC-114, and CFC-115 in non-mechanical heat transfer applications. CO_2 is a well-known, nontoxic, nonflammable gas. Its GWP is defined as 1, and all other GWPs are indexed to it. EPA's understanding is that CO_2 is readily available as a waste gas, and therefore no additional quantity of the chemical needs to be produced for refrigeration applications. Thus, the use of such commercially available CO_2 as a refrigerant does not contribute to global warming, and release of such CO_2 from appliances has no net contribution to global warming. On this basis, EPA proposes to find that release and disposal of CO_2 refrigerant during the servicing and disposal of appliances does not pose a threat to the environment under section 608. EPA requests comment on the factual basis for this proposal.

EPA has approved direct nitrogen expansion as an alternative technology for many CFCs and HCFCs used in vapor compression systems. Nitrogen is a well-known, nontoxic, nonflammable gas that makes up 78% of Earth's atmosphere. Nitrogen contributes neither to global warming nor to ozone-depletion. EPA therefore proposes to find that the release and disposal of elemental nitrogen during the servicing and disposal of appliances does not pose a threat to the environment.

EPA has approved evaporative cooling as an alternative technology to motor vehicle air conditioners using CFC-12. Evaporative cooling operates simply through the evaporation of water to the atmosphere. Water released from evaporative cooling is nontoxic and contributes neither to ozone depletion nor to global warming. EPA therefore proposes to find that the release and disposal of water during the servicing and disposal of appliances does not pose a threat to the environment.

IV. The Proposed Rule

A. *Definitions*

1. Appliance

EPA is proposing to amend the current definition of ''appliance'' to include air-conditioning and refrigeration equipment that contains substitutes for class I and class II substances, as well as equipment that contains class I and class II substances. This amendment is consistent with the definition of ''appliance'' in section 608(c)(2), which states, ''[f]or purposes of this paragraph, the term 'appliance' includes any device which contains and uses as a refrigerant a substitute substance and which is used for household or commercial purposes, including any air conditioner, refrigerator, chiller, or freezer.'' EPA proposes to continue to interpret ''appliance'' to include all air-conditioning and refrigeration equipment except that designed and used exclusively for military applications. Thus, the term ''appliance'' would include household refrigerators and freezers (which may be used outside the home), other refrigeration appliances, residential and light commercial air conditioning, motor vehicle air conditioners, comfort cooling in vehicles not covered under section 609, and industrial process refrigeration.

a. *Inclusion of Heat Transfer Devices in the Term ''Appliance''.* A manufacturer of PFCs has submitted comments requesting that EPA exclude non-mechanical heat transfer applications from the definition of appliance. The manufacturer maintained that ''heat transfer does not involve the use of a refrigerant under the accepted technical definitions of this term,'' and cited the technical definition of refrigerant in the ASHRAE handbook as ''the working fluid in a refrigeration cycle, absorbing heat from a reservoir at low temperature and rejecting heat at a higher temperature.'' In addition, the manufacturer stated that heat transfer applications are such a small segment of the ODS replacement market that they should be exempt from regulation on de minimis grounds. Citing the *Alabama Power Co.* v. *Costle* decision (636 F.2d 323, DC Cir 1979), the commenter argued that EPA may make such exemptions ''if it finds (1) that Congress was not extraordinarily rigid in drafting section 608, and (2) that the burdens associated with regulating the de minimis categories yield trivial benefits.'' Finally, the manufacturer requested that if EPA does decide to continue to consider heat transfer applications appliances, EPA adopt a unique approach to these systems, as they differ physically from ''traditional'' air-conditioning and refrigeration systems. (''Issues Associated with Extending Regulations Under Section 608 to ODS Substitutes Used in Heat Transfer Applications,'' Michael I. Dougherty and Larry G. Headrick, 3M Specialty Chemicals Division, September 5, 1995).

In the past, EPA has considered non-mechanical heat transfer applications that use the heat transfer fluid as the primary refrigerant to be appliances. In an applicability determination issued on June 6, 1993, EPA determined that electrical transformers containing CFC–113 were appliances because the 113 ''acts to transport heat out of the transformer.'' The determination stated further that ''(t)he fact that the transport of heat is accomplished without the use of compressors or expansion valves does not alter the role of the CFC–113 which acts as a coolant.'' Moreover, under the Significant New Alternatives Program, EPA has classified non-mechanical heat transfer applications as part of the refrigeration and air-conditioning major industrial use sector.

EPA does not see any legal, technical, or environmental justification for reversing these findings, although EPA is requesting comment on the option of adopting unique requirements under section 608 for non-mechanical heat transfer applications. As noted above, the fundamental cooling function of the heat transfer fluid is not changed because a compressor is not involved. While one technical definition of ''refrigerant'' may refer only to moving heat from low-to high-temperature regions, commonly accepted dictionary definitions of ''refrigerant'' and ''refrigerate'' refer generally to making or keeping things cool.[9] Neither the statute nor its legislative history indicate that Congress intended the term to be more restrictive in the statute than it is in common use.

Given that heat transfer applications are appliances, EPA does not believe that it would be appropriate to exempt some or all of these applications from recycling requirements because they consume a small quantity of refrigerant relative to other appliance types. The commenter states that de minimis exemptions are permissible where Congress has not been ''extraordinarily

[9] *The Random House College Dictionary* defines ''refrigerate'' as ''to make or keep cold or cool, as for preservation,'' and ''refrigerant'' as ''a substance used as an agent in cooling or refrigeration.'' *Webster's Ninth New Collegiate Dictionary* defines ''refrigerate'' as ''to make or keep cold or cool,'' and ''refrigerant'' as ''a substance used in refrigeration.''

rigid,'' and maintains that section 608 gives the Agency flexibility to exercise its discretion in this area. In support of this argument, the commenter cites the explicit exemptions in section 608(c) for (1) de minimis releases associated with good faith attempts to recover and recycle, and (2) releases of ODS substitutes that do not pose a threat to the environment.

However, the legislative history of section 608 indicates that Congress intended both of these exemptions to be interpreted narrowly. As noted above, the Senate managers of the CAA bill specifically identified releases of substitutes with high global warming potential as a ''threat to the environment,'' and PFCs have among the highest global warming potentials of any refrigerants. The Senate managers also read the following statement into the record regarding the explicit exemption for de minimis releases:

> Exceptions to this provision are included for certain de minimis releases. As used in this context, de minimis refers to extremely small amounts. The fact that de minimis, in other contexts under this Act, may be as much as several tons is not relevant nor controlling in this context. Most appliances contain only a few ounces of class I or class II refrigerant. Interpreting de minimis to mean anything other than an extremely small amount would render this provision a nullity. The exception is included to account for the fact that in the course of properly using recapture and recycling equipment, it may not be possible to prevent some small amount of leakage (Cong. Rec. S 16948 (Oct. 27, 1990)).

Thus, both the statute and the legislative history clearly limit the applicability of the de minimis exemption to those releases that unavoidably occur during the course of recycling. The de minimis exemption is *not* intended to exempt any sector from recycling requirements; indeed, the Senate managers specifically proscribe a broad interpretation of de minimis, noting that it would ''render (section 608(c)) a nullity.''

Furthermore, Congress' explicit provision of a sharply limited exemption from section 608(c) for de minimis releases associated with good faith efforts to recapture and recycle or safely dispose of a substitute undermines the argument that EPA has an understood authority to grant a much broader de minimis exemption under *Alabama Power Co.* v. *Costle*. Congress has specifically addressed the scope of possible exemptions from section 608(c) and declared this scope quite limited. Consequently, EPA has included both small appliances (which individually have very small charge sizes) and very high-pressure appliances (which collectively consume only a small percentage of refrigerants) in the scope of the section 608 recycling requirements.

Moreover, EPA does not believe that the regulation of releases of PFCs used as heat transfer fluids meets either of the criteria established by the court in *Alabama Power* for finding an implied authority to allow a de minimis exemption. De minimis authority may be implied where ''the burdens of regulation yield a gain of trivial or no value.'' *Alabama Power* at 360–61. First, EPA does not consider the benefits of this proposed regulation to be ''trivial.'' The commenter estimates potential annual consumption of PFC heat transfer fluids to be 580,000 pounds, or 264 metric tons. If this consumption is weighted by the average 100-year GWP of the PFCs and compared to the consumption of all other refrigerants weighted by the 100-year GWP of HFC–134a, it makes up 1.5 percent of total refrigerant consumption in the U.S.[10] If the PFC consumption and other refrigerant consumption are weighted by their 500-year GWPs, the PFCs make up 7.2 percent of total U.S. refrigerant consumption.

Second, the commenter does not demonstrate that recycling PFC heat transfer fluids would impose significant burdens. While the unique characteristics and applications of heat transfer appliances may warrant specialized recycling requirements, they do not render recycling impracticable or even extraordinarily difficult. Indeed, the commenter notes that PFC heat transfer fluids are already subject to use restrictions under the SNAP program that require recycling during the servicing and disposal of equipment, and observes that total losses from heat transfer equipment are currently less than 10 percent per year. Moreover, heat transfer applications using CFCs and HCFCs have clearly been subject to section 608 requirements since the applicability determination on electrical transformers was issued in June, 1993. Since EPA has not received any information indicating that users of these applications have been unable to comply, and since PFCs were selected as substitutes for CFCs and HCFCs in these applications precisely because they have similar physical characteristics, there is no reason to believe that recycling PFCs in these applications will be difficult. Thus, EPA is not proposing to exempt heat transfer applications from the requirements of this proposed rule.

b. Coverage of One-Time Expansion Devices. Similarly, EPA believes that one-time expansion devices are appliances, and that the release of refrigerants from one-time expansion devices is prohibited by section 608(c)(2), unless EPA finds that the release of these refrigerants does not pose a threat to the environment. One-time expansion devices, which include ''self-chilling cans,'' rely on the release and associated expansion of a compressed refrigerant to cool the contents (e.g., a beverage) of a container.

EPA considers refrigerant release from such devices to be prohibited by section 608(c). First, the refrigerant in these devices acts as a not-in-kind substitute for CFCs and HCFCs in household and commercial refrigerators. Although the refrigerant in a one-time expansion device is not being used in the same system as CFC–12 in a household or commercial refrigerator, it is providing the same effect of cooling the container. EPA has previously considered not-in-kind technologies, such as evaporative cooling, to be substitutes under SNAP. The SNAP regulation defines ''substitute or alternative'' as ''any chemical, product substitute, or alternative manufacturing process, whether existing or new, intended for use as a replacement for a class I or II compound.'' This approach is consistent with the language of section 612 of the Clean Air Act, in which Congress repeatedly identified ''product substitutes'' as substitutes for class I and class II substances. Section 612(a) states the policy of the section: ''To the maximum extent practicable, class I and class II substances shall be replaced by chemicals, **product substitutes,** or alternative manufacturing processes that reduce overall risks to human health and the environment'' (emphasis added).[11] As stated in the SNAP regulation, EPA has interpreted the phrase ''substitute substances'' in 612(c) to incorporate the general definition of substitute in 612(a) and 612(b) (3) and (4) (59 FR 13050). As noted above, the proposed definition of ''substitute'' in today's document is very similar to that in the SNAP regulations, except the proposed definition omits the proviso that the substitute be *intended* for use as

[10] This figure is based on the commenter's projection of PFC heat transfer fluid consumption and EPA's estimate of U.S. consumption of CFC and HCFC refrigerants in 1992.

[11] Section 612(b)(3) directs EPA to ''specify initiatives * * * to promote the development and use of safe substitutes for class I and class II substances, including alternative chemicals, **product substitutes**, and alternative manufacturing processes'' (emphasis added). Similarly, section 612(b)(4) requires EPA to ''maintain a public clearinghouse of alternative chemicals, **product substitutes**, and alternative manufacturing processes'' (emphasis added).

a replacement for a class I or class II substance. Thus, under the proposed definition in today's document, and consistent with the definition in the SNAP regulations and section 612 of the Act, EPA would consider the refrigerant in a one-time expansion device to be a ''substitute substance'' under section 608(c)(2).

Second, one-time expansion devices, which rely on the release of compressed gases to cool the contents of containers, are encompassed by the term ''appliance.'' A one-time expansion device is a device that holds and uses a substitute substance to make the contents of the container cool for individual consumption. Thus, it is a ''device which contains or uses'' a ''refrigerant'' ''for household or commercial purposes.'' The operating principle of a one-time expansion device, vapor compression and expansion, is the same as that of a traditional refrigerator. The only technological differences between a one-time expansion device and a traditional refrigerator are that, with a one-time expansion device, the compression part of the vapor-compression/expansion cycle takes place at the factory, and the refrigerant escapes during expansion instead of being cycled back to a compressor to be recompressed.

Third, EPA believes that the opening of a one-time expansion device constitutes disposal of the device. This interpretation is consistent with the definition of ''disposal'' included in the recycling regulations for CFCs and HCFCs at § 82.152. ''Disposal'' is the process leading to and including:

(1) The discharge, deposit, dumping or placing of any discarded appliance into or on any land or water;

(2) The disassembly of any appliance for discharge, deposit, dumping or placing of its discarded component parts into or on any land or water; or

(3) The disassembly of any appliance for reuse of its component parts.

The act of opening a one-time expansion device meets this definition of disposal. Opening the device irreversibly discharges the refrigerant and thereby ends the useful life of the cooling device. Cooling the container is a one-time action that occurs immediately prior to consuming or using its contents, after which the remaining component parts of the appliance will be discarded. In addition, with the irreversible discharge of the critical portion of the cooling device, the appliance has been partially disassembled and one of its component parts has been discharged. Thus, the act of opening the device and cooling the container is a process that leads quickly and inevitably to the final disposal of the appliance, and the act itself includes the permanent disassembly of the appliance and discharge of one of the component parts. Finally, the act of opening the device is a ''knowing'' release of refrigerant, as a person opening the device could not fail to be aware that his or her action is causing release of a gas to the atmosphere.

Thus, the release occurs in the course of ''maintaining, servicing, repairing, or disposing of an appliance'' and is subject to the venting prohibition. While EPA is proposing to exempt some substitute refrigerants in one-time expansion applications from the section 608 requirements because their release does not pose a threat to the environment (see the discussion of CO_2 above), EPA does not believe that it can make this finding for the HFC refrigerants that have been suggested for use in one-time expansion devices due to global warming concerns. EPA recognizes that this has the effect of prohibiting the use of HFCs (or other refrigerants whose release EPA does not find does not pose a threat to the environment) in this application. As discussed below, EPA is proposing to use its authority under section 608(c)(2) and section 301(a) to prohibit the manufacture of one-time expansion devices using refrigerants that EPA has not exempted from the venting prohibition.

c. Secondary Loops. Rather than cooling things or people directly, many refrigeration and air-conditioning systems operate by cooling an intermediate fluid, which is then circulated to the things or people to be cooled. This intermediate fluid (and the structure for transporting it) is referred to as a secondary loop. Secondary loops are commonly used in air conditioners in large buildings,[12] in industrial process refrigeration systems, and in some specialty and commercial refrigeration systems.

There are different types of secondary loops. Interpreted in the broadest sense, secondary loops include, on the one hand, the lower temperature loops of cascade systems, and on the other, the ventilation systems that circulate air that is cooled by an air-conditioner, since both of these types of loops circulate a fluid that is cooled by a primary refrigerant loop. However, these loops differ from each other in a number of ways. The former move heat from cooler to warmer areas, and there is a change of state in the secondary fluid. The latter move heat from warmer to cooler areas (because they return air that is warmed by the inhabitants and equipment in the building), and there is no change of state in the secondary fluid. The type of loop that is most commonly considered a secondary loop falls between these two types, but somewhat closer to air circulation systems: it is a closed loop that circulates a liquid that is cooled by a primary refrigerant loop and that is used to move heat from warmer to cooler areas with no change of state.[13]

EPA is requesting comment regarding what types of secondary loops should be considered to be part of an ''appliance.'' The definition of ''appliance'' with respect to secondary loops is somewhat ambiguous under Act. Given this ambiguity, Congress has delegated to EPA the authority to interpret ''appliance'' consistent with the language and purpose of section 608. The purpose of section 608 is to reduce emissions of ozone-depleting substances and to ensure that the phaseout of ozone-depleting refrigerants does not result in new environmental problems from emissions of their replacements.

In defining the boundaries of an appliance, EPA believes that it is appropriate to consider both the proximity of the loop to the primary cooling mechanism and the mode of functioning of the loop (including the direction of heat transfer and whether or not a change of state is involved); otherwise, it may be difficult to draw a clear line between the appliance and its surroundings. For example, a common-sense definition of appliance would probably not include the ventilation system used to circulate cooled air, but, as noted above, such a ventilation system could be considered a secondary loop. In fact, because the transfer of heat from warmer to cooler objects occurs spontaneously, any fluid between the primary loop of an appliance and the things or people cooled could be considered a secondary (or tertiary, etc.) loop. In order to avoid an overly expansive interpretation of ''appliance,'' EPA is proposing to interpret as part of an ''appliance'' refrigerant loops that (1) are primary or (2) move heat from cooler to warmer areas or (3) involve a change of state of the fluid. Under this interpretation, secondary loops that used water, brine, or other materials to transport heat from warmer to cooler areas without a change of state would

[12] Large building air conditioners are commonly called ''chillers,'' which is short for ''water chillers.'' Most building air conditioners cool water or brine that is then circulated throughout the building.

[13] The 1997 *ASHRAE Handbook, Fundamentals,* defines ''secondary coolant'' as ''any liquid cooled by the refrigerant and used to transfer heat without changing state'' (p. 20.1).

not be considered to be part of an ''appliance.'' On the other hand, cascade system secondary loops that used fluids to transport heat from cooler to warmer areas with a change of state would be considered to be part of an ''appliance.'' EPA believes that this interpretation would cover those secondary loops that are traditionally considered to be part of the air conditioner or refrigerator, while excluding those that are not. In addition, the Agency believes that this interpretation would capture the majority of air-conditioning and refrigerating components that have used ozone-depleting substances in the past.

This interpretation is also consistent with EPA's decision not to list secondary fluids under SNAP. In that decision, published on March 10, 1997, EPA expressed concern that listing secondary fluids could discourage their use and could be very burdensome to the Agency and the regulated community, as the number of secondary fluids is quite large. In addition, the Agency noted that there was little information or data suggesting that the use of these fluids in secondary loops posed an environmental or safety risk (52 FR 10700).

The Agency requests comment on its interpretation of ''appliance'' as it applies to secondary loops. Specifically, EPA requests comment on whether there are human health or environmental risks that could be significantly reduced by subjecting to the venting prohibition secondary loops that transport heat from warmer to cooler areas without a change of state. Based on information received to date, the Agency believes that most secondary fluids are either environmentally benign or controlled under other authorities. However, if some secondary fluids were neither benign nor adequately controlled under other authorities, EPA could interpret ''appliance'' to include secondary loops and individually exempt fluids whose release did not pose a threat to the environment. In this way, EPA could subject to the venting prohibition only those secondary fluids whose release posed a threat. Given the large number of secondary fluids, however, the Agency is concerned that it would be difficult to identify and list all of the secondary fluids whose release does not pose a threat.

EPA also requests comment on the extent to which ozone depleting substances such as HCFC–123 are used in secondary loops that transport heat from warmer to cooler areas. EPA believes that such ozone-depleting substances should be recovered, given their environmental impact and the availability of equipment and expertise to recover and recycle them. However, to require such recovery, EPA would not necessarily need to define secondary loops as part of an appliance and thereby subject them to the section 608(c) venting prohibition. Instead, the Agency could use its broad authority to minimize emissions and maximize recycling of class I and class II substances under section 608(a). EPA requests comment on this approach.

2. Full Charge

Compliance with the leak repair requirements requires calculating both the full charge of the appliance and the leak rate. EPA has previously defined full charge at § 82.152 as the amount of refrigerant required for normal operating characteristics and conditions of the appliance as determined by using one or a combination of the four methods specified at § 82.152. Through this action, EPA is proposing to eliminate the phrase ''for the purposes of § 156(i)'' and the word ''all'' from paragraph (2) in the definition of full charge at § 82.152. The definition refers to ''other relevant considerations.'' The term ''all'' is implicit in that language. EPA believes this change will improve the readability of the provision by eliminating redundancy.

3. High-pressure Appliance

As discussed below in section IV.B.1.a, EPA is proposing to base evacuation requirements for CFC, HCFC, HFC, and PFC appliances on the saturation pressure of the refrigerant. As part of this approach, EPA is proposing two changes to its definition of high-pressure appliances. One of the changes would modify the system for classifying refrigerants by their saturation pressures. Rather than classifying the refrigerants according to their boiling points at atmospheric pressure, EPA would classify them according to their saturation pressures at 104 degrees F. The other change would split what are currently defined as high-pressure appliances into two groups. One group would remain subject to the current requirements for high-pressure CFC and HCFC (except HCFC–22) appliances and would continue to be called ''high-pressure appliances.'' The other group would be subject to the current requirements for HCFC–22 appliances and would be called ''higher-pressure appliances,'' as described below.

The proposed revised definition of ''high-pressure appliances'' reads as follows:

High-pressure appliance means an appliance that uses a refrigerant with a liquid phase [14] saturation pressure between 45 psia and 220 psia at 104 degrees Fahrenheit. This definition includes but is not limited to appliances using R114, R12, R134a, R500, and R401A, B, and C.

4. Higher-Pressure Appliance

As described above, EPA is proposing to create a new category of ''higher-pressure appliances'' whose refrigerants have saturation pressures between 220 psia and 305 psia at 104 degrees F. Appliances in this category would be subject to the current requirements for HCFC–22 appliances. The proposed definition of ''higher pressure appliances'' reads as follows:

Higher-pressure appliance means an appliance that uses a refrigerant with a liquid phase saturation pressure between 220 psia and 305 psia at 104 degrees Fahrenheit. This definition includes but is not limited to appliances using R22, R502, R402A and B, and R407A, B, and C.

5. Leak Rate

EPA has not previously promulgated a formal definition for leak rate. Through today's action, EPA is proposing to add a definition for leak rate for the purposes of applying leak repair requirements contained in § 82.156(i). Currently, § 82.156(i) refers to applicable allowable annual leak rates for different appliances. While EPA believes that there is a general understanding on how to calculate leak rates, EPA is proposing to add a specific definition in the regulations for clarity. EPA believes this definition will address some of the issues raised by the Chemical Manufacturers' Association (CMA).

EPA and CMA jointly issued a compliance guide for leak repair in October 1995. That guide, known as the Compliance Guidance For Industrial Process Refrigeration Leak Repair Regulations Under Section 608 of the Clean Air Act (Compliance Guidance), includes a section on calculating leak rates. The Compliance Guidance states that each time the owner or operator adds refrigerant to an appliance normally containing 50 pounds or more of refrigerant, the owner or operator should promptly calculate the leak rate to ensure that the appliance is not leaking at a rate that exceeds the applicable allowable leak rate. If the amount of refrigerant added indicates

[14] Zeotropic blends exert different pressures at the same temperature, depending upon the percentage of vapor vs. liquid in the container. For reasons discussed below in section IV.B.1.a., EPA is proposing to classify refrigerants according to their liquid phase saturation pressures at 104 degrees F.

that the leak rate for the appliance is above the applicable allowable leak rate, the owner or operator must perform corrective action by repairing leaks, retrofitting the appliance, or retiring the appliance in accordance with the requirements of § 82.156(i). As noted below, the applicable allowable leak rate for commercial refrigeration and industrial process refrigeration equipment normally containing 50 pounds or more of refrigerant is currently 35 percent, but EPA is proposing to lower this for some types of equipment. The applicable allowable annual leak rate for all other appliances normally containing 50 pounds or more of refrigerant is currently 15 percent, but again, EPA is proposing to lower this.

The Compliance Guidance specifically mentions two methods for calculating leak rates. One method for calculating the leak rate is described in the Compliance Guidance as follows:

(1) Take the number of pounds of refrigerant added to the appliance to return it to a full charge and divide it by the number of pounds of refrigerant the appliance normally contains at full charge;

(2) Take the number of days that have passed since the last day refrigerant was added and divide by 365 days;

(3) Take the number calculated in step (1) and divide it by the number calculated in step (2); and

(4) Multiply the number calculated in step (3) by 100 to calculate a percentage.

This method is summarized in the following formula:

$$\text{Leak rate (\% per year)} = \frac{\text{pounds of refrigerant added}}{\text{pounds of refrigerant in full charge}} \times \frac{\text{365 days/year}}{\text{\# days since refrigerant last added}} \times 100\%$$

Because this method takes the quantity of refrigerant (percentage of charge) lost between charges and scales it up or down to calculate the quantity that would be lost over a year-long period, it will be referred to as the ‘‘annualizing method.’’

The second method mentioned in the Compliance Guidance is to calculate the ‘‘rolling average.’’ The term ‘‘rolling average’’ is not defined in the Compliance Guidance, but EPA believes it is commonly calculated by:

(1) Summing up the quantity of refrigerant (e.g., pounds) added to the appliance over the previous 365-day period (or over the period that has passed since leaks in the appliance were last repaired, if that period is less than one year),

(2) Dividing the result of step one by the quantity (e.g., pounds) of refrigerant the appliance normally contains at full charge, and

(3) Multiplying the result of step two by 100 to obtain a percentage.

This method is summarized in the following formula:

$$\text{Leak rate (\% per year)} = \frac{\begin{array}{c}\text{pounds of refrigerant added over past 365 days}\\ \text{(or since leaks were last repaired)}\end{array}}{\text{pounds of refrigerant in full charge}} \times 100\%$$

EPA is considering four options for its formal definition of ‘‘leak rate.’’ The first option is to require appliance owners to calculate leak rates using only the ‘‘annualizing’’ method. The second option is to require owners to calculate leak rates using only the ‘‘rolling average’’ method. The third option is to require owners to calculate leak rates using whichever of the two methods yields the higher calculated leak rate, and the fourth option is to permit owners to calculate leak rates using either method, so long as the same method is always used for the same appliance, facility, or firm.

EPA believes that there are advantages and disadvantages to each approach. The annualizing method is relatively simple, catches some kinds of leaks more quickly than the rolling average method.[15] and does not penalize owners whose appliances leak slowly but show no signs of leakage until a relatively large percentage of the charge has been lost. On the other hand, the annualizing method permits owners whose appliances spring a fast leak after a long period of slow leakage to delay repair, because it permits them to ‘‘dilute’’ the true leak rate by averaging the refrigerant loss over more than one year.

The rolling average method is relatively simple and catches some kinds of leaks (such as the sudden fast leak described in the previous paragraph) more quickly than the annualizing method. On the other hand, the rolling average method permits owners to delay repair of certain types of leaks longer than the annualizing method, and it may force owners whose appliances actually leak below the applicable leak rate to undertake repair, especially if these owners have no way of recognizing that they have a leak until a relatively large percentage of the charge has been lost.

Requiring the use of whichever method yields the highest calculated leak rate is a more complicated approach (both for compliance and enforcement) than requiring the use of either method alone, but ensures that leaks are caught as quickly as possible. However, because this approach incorporates the rolling average method, it shares that method's potential to penalize appliance owners whose appliances leak below the applicable leak rate but do not show signs of leakage until they have lost a relatively large percentage of charge.

Permitting appliance owners to use the method of their choice to calculate leak rates is somewhat more complicated to enforce than requiring either method alone, but could be easier for owners to comply with if they have more experience with one method than the other. It might permit owners to select the method that permits them to perform leak repair less frequently, but both the annualizing and rolling average methods eventually catch all leaks above the maximum allowable rate. Because appliance owners using the rolling average method would be doing so at their discretion, this approach neutralizes any equity concerns associated with that method. However, to implement this approach, EPA would have to resolve two issues. First, the Agency would have to implement some

[15] Suppose a previously leak-tight appliance springs a leak. If the appliance owner is adding *less* than the applicable allowable percentage of charge and the time since the last recharge is *less* than one year, the annualizing method will force the owner to repair the leaks before the rolling average method will. If an appliance owner is adding *more* than the applicable allowable percentage of charge and the time since the last recharge is *more* than one year, the reverse holds true.

type of recordkeeping requirement (1) to ensure that once appliance owners chose a method for calculating leak rates, they used the same method consistently, and (2) to permit EPA inspectors to understand and audit leak repair records. Second, EPA would have to determine whether the same method for calculating leak rates should be used for individual appliances, whole facilities, or entire firms. EPA believes that using different methods for different appliances within the same facility would be excessively confusing and difficult to enforce; the Agency would prefer the same method to be used on a facility or firm basis.

EPA is proposing the third option, requiring use of whichever method yields the higher calculated leak rate, as its lead option. Specifically, EPA is proposing to define ''leak rate,'' as follows:

Leak rate means the rate at which an appliance is losing refrigerant, measured between refrigerant charges or over 12 months, whichever is shorter. The leak rate is expressed in terms of the percentage of the appliance's full charge that would be lost over a 12-month period if the current rate of loss were to continue over that period. The rate is calculated using the following method:

(1) Take the number of pounds of refrigerant added to the appliance to return it to a full charge and divide it by the number of pounds of refrigerant the appliance normally contains at full charge;

(2) Take the shorter of (a) 365 days and (b) the number of days that have passed since the last day refrigerant was added and divide that number by 365 days;

(3) Take the number calculated in step (1) and divide it by the number calculated in step (2); and

(4) Multiply the number calculated in step (3) by 100 to calculate a percentage.

This method is summarized in the following formula:

$$\text{Leak rate (\% per year)} = \frac{\text{pounds of refrigerant added}}{\text{pounds of refrigerant in full charge}} \times \frac{\text{365 days/year}}{\text{shorter of: \# days since refrigerant last added and 365 days}} \times 100\%$$

Note that using this formula is equivalent to using whichever of the two formulas above yields the higher calculated leak rate, since it reduces to the formula for the annualizing method if less than one year has passed since refrigerant was last added, while it reduces to the formula for the rolling average method if more than one year has passed since refrigerant was last added.

The Agency believes that this approach would require owners to repair leaks quickly without being unduly burdensome. EPA requests comment on this approach and on the other options presented here.

6. Low-pressure Appliance

EPA is proposing to revise the definition of ''low-pressure appliance'' to refer to saturation pressures at 104 degrees F rather than boiling points. The proposed revised definition reads: Low pressure appliance means an appliance that uses a refrigerant with a liquid phase saturation pressure below 45 psia at 104 degrees Fahrenheit. This definition includes but is not limited to appliances using R11, R123, and R113.

7. Opening

EPA is proposing to amend the definition of ''opening'' to include service, maintenance, or repair on an appliance that would release class I, class II, or substitute refrigerants unless the refrigerant were recovered previously from the appliance.

EPA is also requesting comment on adding disposal to the definition of ''opening;'' see section IV.F. for a discussion of this option.

8. Reclaim

EPA is proposing to amend the definition of ''reclaim'' to reflect the proposed update of the refrigerant purity standards at appendix A from standards based on ARI 700–1993 to standards based on ARI 700–1995. In addition, EPA is proposing to slightly reword the definition of ''reclaim'' to remove the reference to a ''purity'' standard and thereby make the definition more consistent with the full range of requirements provided in appendix A. EPA has always interpreted § 82.154(g) and § 82.164 to require that persons who ''reclaim'' refrigerant must reprocess the refrigerant to *all* of the specifications of appendix A that are applicable to that refrigerant and to verify that the refrigerant meets these specifications using the analytical methodology prescribed in appendix A.

9. Refrigerant

Although the regulations currently use the term ''refrigerant'' in several places, EPA has not previously defined this term. EPA is proposing to add a definition of ''refrigerant'' that would include any class I or class II substance used for heat transfer purposes, or any substance used as a substitute for such a class I or class II substance by any user in a given end-use, except for the following substitutes in the following end-uses:

Ammonia in commercial or industrial process refrigeration or in absorption units
Hydrocarbons in industrial process refrigeration (processing of hydrocarbons)
Chlorine in industrial process refrigeration (processing of chlorine and chlorine compounds)
Carbon dioxide in any application
Nitrogen in any application
Water in any application

EPA is proposing this definition primarily to simplify the rule. The proposed definition would permit EPA to refer to covered class I, class II, and substitute refrigerants without having to reiterate a list of either included or excepted refrigerants each time. At the same time, EPA believes that the proposed definition would appropriately define ''refrigerant'' for purposes of section 608. The Agency does not intend the definition either to expand or diminish the scope of the section 608 requirements, and believes that the definition is consistent with EPA's past interpretations of the term ''refrigerant.'' In the past, EPA has interpreted ''refrigerants'' to include the fluids in traditional vapor-compression systems, such as refrigerators, air-conditioners, and heat pumps, as well as the fluids in heat transfer systems that lack compressors, such as electrical transformers. EPA has adopted this interpretation based on both technical and common definitions of ''refrigerant.'' The Agency believes that the proposed definition would cover the fluids covered by the technical and common definitions. The rationale for the proposed exceptions is discussed above in section III.B.

As discussed above, EPA is proposing to interpret ''appliance'' to exclude secondary loops that move heat from warmer to cooler areas using a fluid that does not change state. If EPA retains its proposed interpretation of ''appliance,'' the Agency could add a restriction to the definition of ''refrigerant'' to the same effect, ensuring consistency between the interpretation of ''appliance'' and the definition of ''refrigerant.'' EPA requests comment on this option, and on the proposed definition.

10. Substitute

EPA is proposing to define ''substitute'' as any chemical or product substitute, whether existing or new, that is used by any person as a replacement for a class I or II compound in a given end-use. As discussed in section I.B. above, this definition is similar to the definition of ''substitute'' used in the SNAP rule, but it omits the proviso that a substitute be ''*intended* for use as a replacement for a class I or class II substance.'' Thus, it includes substances that may not have been used to replace class I or class II substances in a given instance, but are used to replace class I or class II substances in other instances of that end-use.

11. Technician

EPA is amending the definition of technician to include persons who perform maintenance, service, repair, or disposal that could be reasonably expected to release class I, class II, or substitute refrigerants from appliances into the atmosphere.

12. Very-High-Pressure Appliance

EPA is proposing to revise the definition of ''very-high-pressure appliance'' to refer to saturation pressures at 104 degrees Fahrenheit rather than boiling points. Because 104 degrees F is above the critical temperatures of many very-high-pressure refrigerants, meaning that there is no ''saturation pressure'' in the usual sense for those refrigerants at that temperature, EPA is also adding the phrase ''or with a critical temperature below 104 degrees Fahrenheit'' to the definition. The proposed revised definition reads as follows:

Very-high-pressure appliance means an appliance that uses a refrigerant with a critical temperature below 104 degrees Fahrenheit or with a liquid phase saturation pressure above 305 psia at 104 degrees Fahrenheit. This definition includes but is not limited to appliances using R410A and B, R13, R23, and R503.

B. Required Practices

EPA is proposing to require persons servicing or disposing of air-conditioning and refrigeration equipment that contains HFCs and PFCs to observe certain service practices that minimize emissions of these refrigerants. As noted above, these service practices are very similar to those required for the servicing or disposal of CFC and HCFC equipment. The most fundamental of these practices is the requirement to recover HFC and PFC refrigerants rather than vent them to the atmosphere. As noted above, the knowing venting of substitutes for class I and class II refrigerants (except those exempted by the Administrator) during maintenance, service, repair or disposal is expressly prohibited by section 608(c)(1) and (2) of the Act, as of November 15, 1995. Section 608(c)(1) exempts from the prohibition de minimis releases associated with good faith attempts to recapture and recycle or safely dispose of these refrigerants.

The statutory language of section 608(c)(2) simply extends to substitute refrigerants the section 608(c)(1) prohibition on venting of class I and II substances and its exemption for de minimis releases associated with good faith attempts to recapture and recycle or safely dispose of refrigerant. For releases of class I and II substances, EPA has interpreted as ''de minimis releases associated with good faith attempts to recapture and recycle or safely dispose'' of refrigerants, releases that occur despite compliance with EPA's required practices for recycling and recovery under 40 CFR 82.156, including use of recovery or recycling equipment certified under 40 CFR 82.158. Compliance with the regulations represents ''good faith attempts to recapture and recycle or safely dispose'' of refrigerant, and consequently releases that occur despite such compliance should be considered de minimis releases under section 608(c).[16] EPA proposes to interpret the phrase ''good faith attempts to recapture and recycle or safely dispose'' similarly when it applies to section 608(c)(2). Thus, ''good faith attempts to recapture and recycle or safely dispose'' of substitute refrigerants are defined by the proposed provisions concerning evacuation of equipment, recycling and recovery, use of certified equipment, and technician certification. EPA believes that these provisions appropriately define good faith attempts to recapture and recycle or safely dispose of substitute refrigerants for the reasons discussed in EPA's justification of each provision. Under this approach, emissions that take place during servicing or disposal when these provisions are not followed would not be de minimis emissions.

To implement section 608(c)(2) more effectively, EPA proposes not only to define ''good faith attempts to recapture and recycle or safely dispose'' according to the proposed provisions, but also more directly to require compliance with the proposed provisions for substitute refrigerants regarding evacuation of equipment, use of certified equipment, and technician certification in any instance where a person is opening (or otherwise violating the refrigerant circuit) or disposing of an appliance, as defined in 40 CFR 82.152. It is physically impossible to open appliances (or otherwise violate the refrigerant circuit) or dispose of appliances without emitting at least some refrigerant, even if some effort is made to recapture the refrigerant. Even after the appliance has been evacuated, some refrigerant remains, which is released to the environment when the appliance is opened or disposed of. Other activities that fall short of opening but that involve violation of the refrigerant circuit also release refrigerant, albeit very small quantities, because connectors (e.g., between hoses or gauges and the appliance) never join together with no intervening space. Even in the best case in which a good seal is made between a hose and an appliance before the valve between them is opened, some refrigerant will remain in the space between the valve and the outer seal after the former is closed. This refrigerant will be released when the outer seal is broken. Thus, whenever a person opens an appliance (or otherwise violates the refrigerant circuit) or disposes of an appliance, he or she will necessarily violate the venting prohibition unless the exception for de minimis releases applies. Because EPA is proposing to define the exception such that it only applies when the person complies with the proposed provisions related to recapture, recycling and disposal, compliance with the section 608(c)(2)

[16] EPA believes that both the statute and its legislative history support this interpretation of ''de minimis releases associated with good faith attempts to recapture and recycle or safely dispose of any such substance.'' Given the lack of specificity in the statute, Congress clearly intended to give EPA discretion to interpret the meaning of the phrase. Moreover, EPA's interpretation is consistent with the legislative history on the provision. As noted above, the Senate managers explained in their report that the exception for de minimis releases was ''included to account for the fact that in the course of properly using recapture and recycling equipment, it may not be possible to prevent some small amount of leakage'' (Congressional Record S16948, October 26, 1990). The Senate managers clearly equated ''properly using recapture and recycling equipment'' with ''good faith attempts to recapture'' refrigerant. EPA believes that the Senate managers' term ''properly using'' implies at least compliance with the requirements to evacuate appliances to certain levels, to use certified recovery equipment, and to become certified as a technician.

venting prohibition would require compliance with the proposed provisions. EPA believes that given this factual context, it has sufficient authority under sections 608(c)(2) and 301(a) to implement section 608(c)(2) by simply requiring compliance with the proposed provisions, as a matter of law, without in each instance first requiring a demonstration that the person's activities have actually released refrigerant.

1. Evacuation of Appliances

EPA is proposing that before HFC and PFC appliances are opened for maintenance, service, or repair, the refrigerant in either the entire appliance or the part to be serviced (if the latter can be isolated) must be transferred to a system receiver or to a certified recycling or recovery machine. (As discussed below in the equipment certification discussion, EPA is proposing to permit technicians to recover HFCs or PFCs using equipment certified for use with multiple CFC or HCFC refrigerants of similar saturation pressures.) The same requirements would apply to equipment that is to be disposed of, except for small appliances, MVACs, and MVAC-like appliances, whose disposal is covered under section c. below. EPA is proposing that HFC and PFC appliances be evacuated to established levels that are the same as those for CFCs and HCFCs with similar saturation pressures. At the same time, in order to implement an approach based solely on saturation pressures, EPA is proposing minor changes to the current system for classifying CFC and HCFC appliances. As for CFCs and HCFCs, evacuation levels for HFCs and PFCs would also depend upon the size of the appliance and the date of manufacture of the recycling and recovery equipment.

Technicians repairing MVAC-like appliances are not subject to the evacuation requirements below, but are subject to a requirement to "properly use" (as defined at 40 CFR 82.32(e)) recycling and recovery equipment approved pursuant to § 82.36(a).

a. Evacuation Requirements for Appliances Other Than Small Appliances, MVACs, and MVAC-like Appliances. Table I lists the proposed levels of evacuation for air-conditioning and refrigeration equipment other than small appliances, MVACs, and MVAC-like appliances. These levels would apply to equipment containing CFCs and HCFCs as well as HFCs and PFCs. The Agency has considered a number of factors in developing these levels, including the technical capabilities, ease of use, and costs of recycling and recovery equipment, the thermodynamic characteristics of the HFC and PFC refrigerants, the need for a relatively simple and consistent regulatory scheme for all refrigerants, the servicing times that would be necessary to achieve different vacuums, and the amounts of refrigerant that would be released under different evacuation requirements and their impact on the environment.

TABLE 1.—REQUIRED LEVELS OF EVACUATION FOR APPLIANCES

[Except for small appliances, MVACs, and MVAC-like appliances]

Type of appliance	Inches of Hg vacuum (relative to standard atmospheric pressure of 29.9 inches Hg)	
	Using recovery or recycling equipment manufactured or imported before Nov. 15, 1993	Using recovery or recycling equipment manufactured or imported on or after Nov. 15, 1993
Very high-pressure appliance	0	0.
Higher-pressure appliance, or isolated component of such appliance, normally containing less than 200 pounds of refrigerant.	0	0.
Higher-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant.	4	10.
High-pressure appliance, or isolated component of such appliance, normally containing less than 200 pounds of refrigerant.	4	10.
High-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant.	4	15.
Low-pressure appliance	25	25 mm Hg absolute.

As noted above, the evacuation requirements in Table 1 are very similar to those currently in place for CFC and HCFC appliances. The current evacuation requirements for CFC and HCFC appliances are based largely, but not entirely, on their saturation pressures. (Refrigerants are actually classified according to their boiling points at atmospheric pressure, which are generally inversely related to their saturation pressures at higher temperatures.) The current regulation has three saturation pressure categories for appliances: low pressure, high-pressure, and very-high-pressure. Successively deeper vacuums are required for lower pressure appliances.

EPA adopted this approach because the saturation pressure of a refrigerant is directly related both to the percentage of refrigerant that is recovered at a given vacuum level and to the compression ratio that is necessary to achieve that vacuum.[17] A comparison between R502, which has a saturation pressure of 245 psia at 104°F, and R11, which has a saturation pressure of 25.3 psia at 104°F, makes this clear. At an evacuation level of 10 inches of mercury vacuum and an ambient temperature of 104°F, 96

[17] The saturation pressure of a refrigerant is the same as its vapor pressure, that is, the characteristic pressure of the vapor in a vapor/liquid mixture of that refrigerant at equilibrium at a given temperature. A compression ratio 'is the ratio of the pressures of a gas on the discharge and suction sides of the compressor.

percent of R502 refrigerant vapor has been recovered, but only 61 percent of R11 refrigerant vapor has been recovered. For R502, the compression ratio necessary to achieve this vacuum is about 25 to 1, but for R11 the compression ratio necessary is only about one tenth of that, 2.6 to 1. Most recovery compressors have a compression ratio limit of between 20 and 30 to 1, meaning that it is difficult to achieve an evacuation level much lower than 10 inches of vacuum for R502, but that it is easy to achieve a lower evacuation level for R11. Thus, a refrigerant's saturation pressure directly affects both the technical feasibility and the environmental impact of a given evacuation level.

However, saturation pressure is not the only factor affecting the feasibility and cost-effectiveness of various evacuation levels for appliances. Other considerations include the discharge temperature of the refrigerant (the temperature of the refrigerant as it emerges from the compressor) and the social value of the refrigerant (which includes both its price and the environmental damage avoided by containing it). Due to these considerations, EPA established a special set of evacuation requirements for R–22 appliances, which would otherwise have been treated as high-pressure appliances. EPA established somewhat less stringent requirements for R22 appliances because (1) R–22 has both a relatively high saturation pressure and a relatively high discharge temperature among high-pressure refrigerants, making it relatively difficult to evacuate deeply, and (2) R–22 has a low ODP compared to R12, R500, and R502, all of which contain CFCs (58 FR 28674).

When EPA began its evaluation of possible evacuation levels for HFC appliances, the Agency believed that it might be appropriate to establish less stringent levels for these refrigerants than for CFCs of similar saturation pressure, following the precedent established with R22. On a pound-for-pound basis, EPA estimates that HFCs generally cause less environmental harm than the CFCs they replace. However, when EPA performed its analysis of the costs and benefits of attaining various vacuum levels, it found that the social cost of releasing the HFCs and PFCs (which, again, is a combination of the lost private value of the refrigerant and the environmental damage that results from its release) justified reaching vacuum levels only slightly less deep than those for the CFCs being replaced. For instance, EPA found that the socially optimal level of evacuation for R12 appliances containing 50 pounds of refrigerant was 15 to 22 inches of vacuum [18], while the socially optimal level of evacuation for R134a appliances containing the same quantity was 8 to 17 inches of vacuum.[19] Based on these results, the most important factor in determining appropriate evacuation levels for any particular charge size appears to be the saturation pressure of the refrigerant.

Moreover, standards set by saturation pressure would be easier for technicians to remember and implement than standards that varied both by saturation pressure and type of refrigerant. The current CFC and HCFC regulations contain 12 categories of evacuation requirements, a number that could conceivably be doubled if EPA established new categories for HFCs. EPA believes that the limited benefit that might be gained by such ''fine-tuning'' is outweighed by the confusion and non-compliance that could result from the proliferation of different requirements. Many participants at the March 10, 1995, industry meeting on substitutes recycling expressed a belief that establishing consistent requirements for CFCs, HCFCs, HFCs, and PFCs would enhance compliance with the recovery requirements for all of these refrigerants.

EPA is proposing two changes to the current system for classifying appliances in order to implement an approach based solely upon saturation pressure. The first proposed change is to classify refrigerants according to their saturation pressures at 104 degrees F rather than their boiling points. The second proposed change is to eliminate the special category for R22 and to replace it with a new saturation pressure category that includes the ''high-pressure'' refrigerants with the highest saturation pressures.

EPA is proposing to classify refrigerants according to their saturation pressures at 104 degrees F [20] because many of the refrigerants that have entered the market over the past few years pose two difficulties for the existing system based on boiling points. First, many of the new HFC and HCFC blends do not have precise boiling points. Instead, these refrigerants exhibit ''glide,'' boiling and condensing over a range of temperatures at a given pressure. Second, refrigerants' boiling points have served as a surrogate for their saturation pressures at higher temperatures, but the relationship between boiling point and saturation pressure is not as consistent for the new refrigerants as it is for traditional CFCs and HCFCs. For instance, a lower boiling point has generally indicated a higher saturation pressure at a given temperature. However, R402B, with a boiling point of −53.2 degrees F, actually has a lower saturation pressure at 104 degrees F than R407A, with a boiling point of −49.9 degrees. The new approach avoids these difficulties because it links evacuation requirements directly to the refrigerant saturation pressure at a temperature similar to those where recovery typically takes place.

EPA has attempted to select bracketing saturation pressures for appliance categories so as to maintain as much consistency as possible with the current categories based on boiling points. For instance, because the current definition of ''high-pressure appliances'' includes R114 appliances at the low-pressure end, and the saturation pressure of R114 at 104 degrees F is slightly above 45 psia, EPA is proposing to use a saturation pressure of 45 psia as the lower-bound saturation pressure for high-pressure appliances.

One issue raised by the proposed approach is how to classify appliances using very high pressure refrigerants such as R13, R23, and R503. These

[18] EPA established a 10-inch vacuum level for equipment containing less than 200 lbs of high-pressure refrigerant in consideration of the fact that this evacuation requirement would apply not only to large R12 appliances, but to smaller R12 appliances and to appliances containing somewhat higher pressure refrigerants (e.g., R502). Very deep evacuation requirements were not justified for the last two. In addition, many appliances are likely serviced at higher temperatures than the 70° used in EPA's model, making attainment of deep vacuums more difficult.

[19] Calculated optimal vacuums depend upon labor costs, the estimated social cost of releasing the refrigerant, the displacement of the recovery device compressor, and the clearance of the recovery device compressor. The 8-inch optimal vacuum is based on relatively low compressor displacement, relatively high compressor clearance, and the assumption that the release of one kilogram of R134a would cause about 60 cents worth of environmental damage; the 17–inch optimal vacuum is based upon relatively high compressor displacement, relatively low compressor clearance, and the assumption that the release of one kilogram of R134a would cause about six dollars worth of environmental damage. If the R134a is assumed to cause *no* damage (which, for the reasons discussed in section III.B.2, is an extremely unlikely assumption), the lower-bound optimal vacuum rounds to seven inches.

[20] Zeotropic blends exert different pressures at the same temperature, depending upon the percentage of vapor vs. liquid in the container. For instance, a container of R407C vapor has a saturation pressure of 223.8 psia at 104 degrees, while a container of R407C liquid has a saturation pressure of 254.5 psia at 104 degrees. EPA is proposing to classify refrigerants according to their liquid saturation pressures at 104 degrees F. This is because the vacuum that can be drawn on an appliance is determined by the discharge pressure against which the recovery compressor must pump near the conclusion of the recovery process, and this discharge pressure is that of a recovery tank that is likely to be nearly filled with liquid.

refrigerants do not have a saturation pressure in the traditional sense at 104 degrees F because this temperature is above their critical temperatures. (As noted above, the saturation pressure of a refrigerant is the pressure of the vapor in a vapor/liquid mixture, but refrigerants above their critical temperatures cannot exist in a liquid state regardless of the pressure.) To address this concern, EPA is proposing to modify the definition of very high pressure appliances to add the phrase ''or whose critical temperatures fall below 104 degrees F.''

EPA requests comment on its proposed use of refrigerants' saturation pressures at 104 degrees F rather than boiling points to classify them. An alternative might be to retain the current system based on boiling points, making allowances for temperature glide. For example, in cases where glide caused a refrigerant to straddle the line between two pressure categories, EPA could place the ''straddling'' refrigerant into the category suggested by the lower end of the boiling range (the ''bubble point''). This point is the one typically listed in pressure-temperature charts, and EPA believes that it is the point that would determine the maximum evacuation level (minimum pressure) that is physically possible for the refrigerant.

Some custom refrigerant blends exhibit very large glides (e.g., over 60 degrees Celsius). For such refrigerants, the appropriate evacuation level may be difficult to predict based on either saturation pressure or a single ''bubble'' or ''dew'' point. EPA has worked and will continue to work with the manufacturers of these refrigerants to determine appropriate evacuation levels on a case-by-case basis.

The second change that EPA is proposing to the current classification scheme is to eliminate the special category for R22 and to replace it with a new saturation pressure category that includes the ''high-pressure'' refrigerants with the highest saturation pressures (those with boiling points approximately between −40 and −50 degrees C and saturation pressures between 220 psia and 305 psia at 104 degrees F). EPA would designate this as the ''higher-pressure'' refrigerants category. This would enable EPA to tailor requirements to refrigerants with relatively high saturation pressures without increasing the overall number of categories. The new category would include appliances containing R22, R502, R404C, and R407 A, B, and C, and would be subject to the same requirements as R22 appliances. For several of these refrigerants, the combination of a relatively high saturation pressure and high discharge temperature makes recovery into a deep vacuum difficult. On the other hand, these refrigerants have significantly lower saturation pressures than still higher pressure refrigerants, such as R410A and B (with saturation pressures near 350 psia) and R13 and R503 (whose critical temperatures fall below 104 degrees F).

EPA requests comment on the establishment of the ''higher-pressure'' saturation pressure category. EPA specifically requests comment on the proposed use of 305 psia as the upper bound saturation pressure for this category. The pressures to which R22 appliances must be evacuated (and therefore to which ''higher-pressure'' appliances would have to be evacuated) are 0 inches of vacuum, or atmospheric pressure, for appliances containing less than 200 pounds of refrigerant, and 10 inches of vacuum, or 9.8 psia, for appliances containing more than 200 pounds of refrigerant. Drawing a 10-inch vacuum on an appliance containing a refrigerant with a saturation pressure of 305 psia would require recovery equipment to attain a compression ratio of 30 to 1. EPA's current understanding is that this is very close to the maximum achievable compression ratio for most recovery compressors, and may even be beyond the abilities of some models. (However, the compression ratio necessary to achieve this vacuum may be lowered by cooling the condenser of the recovery equipment.) Thus, it may be appropriate to establish a different upper-bound saturation pressure for this category, such as 265 psia.

EPA also requests comment on whether it is appropriate to include R502 (which has a relatively low discharge temperature) in this category, or whether the possibility of drawing a deeper vacuum on this refrigerant merits its inclusion in a lower-pressure category despite the confusion that might result.

One concern raised at the March 10, 1995, meeting was whether the energy consumption associated with lengthy operation of recovery equipment might result in the emission of more global warming gases (CO_2) than would be contained through continuing the refrigerant recovery process, removing the justification for deep recovery. To investigate this concern, EPA and a laboratory that tests recovery and recycling equipment compared the rates of power consumption (and resultant emissions of CO_2) and refrigerant recovery for both high- and low-pressure recovery equipment. Both the CO_2 emissions rate and the refrigerant recovery rate were weighted by the GWPs of the gases being emitted or captured. (Both the EPA and laboratory analyses are included in the docket for this rulemaking.) The conclusion of both EPA and the laboratory was that the rate of CO_2 emission resulting from use of recovery equipment was dwarfed by the rate of refrigerant recovery even at the latest (and therefore slowest) stages of recovery. Specifically, the minimum rate of refrigerant recovery for high-pressure recovery equipment was greater than the maximum rate of CO_2 emissions attributable to recovery by more than a factor of 2000, and the minimum rate of recovery for low-pressure equipment out paced the rate of CO_2 emissions by a factor of over 1000. These large differences are in part attributable to the high global warming potential of most HFC refrigerants compared to CO_2.

b. Evacuation Levels for Small Appliances. EPA is proposing to establish the same evacuation requirements for servicing small appliances charged with HFCs as it has for small appliances charged with CFCs and HCFCs. Technicians opening small appliances for service, maintenance, or repair would be required to use equipment certified either under Appendix B, ARI 740–1993, or under Appendix C, Method for Testing Recovery Devices for Use with Small Appliances, to recover the refrigerant.

Technicians using equipment certified under Appendix C would have to capture 90 percent of the refrigerant in the appliance if the compressor were operating, and 80 percent of the refrigerant if the compressor were not operating. Because the percentage of refrigerant mass recovered is very difficult to measure on any given job, technicians would have to adhere to the servicing procedure certified for that recovery system under Appendix C to ensure that they achieve the required recovery efficiencies.

Technicians using equipment certified under Appendix B would have to pull a four-inch vacuum on the small appliance being evacuated.

c. Evacuation Levels for Disposed MVACs, MVAC-like Appliances, and Small Appliances. EPA is proposing to establish the same evacuation requirements for disposing of small appliances, MVACs, and MVAC-like appliances that are charged with HFCs as it has for these types of appliances charged with CFCs and HCFCs. MVACs and MVAC-like appliances would have to be evacuated to 102 mm (approximately four inches) of mercury vacuum, and small appliances would have to have 80 or 90 percent of the refrigerant in them recovered (depending on whether or not the compressor was operating) or be evacuated to four inches of mercury vacuum.

d. Request for Comment on Establishing Special Evacuation Requirements for Heat Transfer Appliances. As noted in section IV.A.1.a. above, EPA received comments from a manufacturer of PFCs that stated that special evacuation requirements may be appropriate for certain types of heat transfer appliances containing PFCs, such as some types of electrical transformers. The commenter specifically noted that evacuating some types of heat transfer systems may result in damage to those systems, that in many cases, parts to be repaired may be isolated from the refrigerant charge, and that many repairs may be performed quickly, releasing little refrigerant even if the system is not evacuated.

EPA does not currently believe that special evacuation requirements for heat transfer appliances are necessary, for two reasons. First, EPA has not heard from users or servicers of heat transfer appliances that the current requirements regarding the recovery of CFCs and HCFCs from such appliances (which are the same as those for similarly sized appliances containing refrigerants of similar pressure) are difficult to implement. Because PFCs have physical characteristics similar to those of the CFCs that they replace in heat transfer appliances, EPA believes that any potential problems associated with implementing the proposed evacuation requirements for PFCs would have already surfaced with CFCs and HCFCs. Second, the current evacuation provisions appear to adequately address most of the situations that the commenter has identified. Specifically, the current regulations establish an exception to the evacuation requirements for non-major repairs and permit isolation of parts to be repaired. Before non-major repairs, technicians need only evacuate (or pressurize, in the case of low-pressure appliances) appliances to atmospheric pressure. If a part can be isolated from the refrigerant charge, technicians may repair the part without recovering the refrigerant into an external container.

EPA requests comment on the need for special evacuation requirements for heat transfer appliances in light of the arguments presented here.

e. Proposed Clarifications of Evacuation Requirements. EPA has received a request for two clarifications of the evacuation requirements for appliances. The first request for clarification concerns whether a part of the appliance that is not a separate tank may be considered a ‘‘system receiver,’’ in which the system charge may be isolated while another, isolated part of the appliance is opened for repairs. The second request for clarification concerns whether an isolated portion of an appliance that already meets the required level of evacuation due to normal operating characteristics may be opened for repairs without further evacuation. In addition to proposing a minor change to the regulatory language to respond to the first request, EPA is proposing to add language to § 82.156(a) to clarify that, except in the case of non-major repairs to low-pressure appliances, liquid refrigerant must be removed from appliances (or from the isolated parts to be serviced) before they are opened to the atmosphere.

Regarding the first request for clarification, EPA is today clarifying that, for purposes of complying with § 82.156(a), EPA interprets the term ‘‘system receiver’’ to include a part of the appliance that is not a separate tank, if that portion of the appliance can be isolated from the portion of the appliance that is opened for repairs. From an environmental perspective, EPA believes that the critical consideration is whether the part of the appliance to be opened to the atmosphere for repair has had the refrigerant removed and isolated from it, not the configuration of the remaining appliance parts within which the refrigerant is isolated. To clarify this point, EPA is proposing to amend § 82.156(a) by adding the following examples after the term ‘‘system receiver’’: ‘‘(e.g., the remaining portions of the appliance, or a specific vessel within the appliance)’’. EPA requests comment on this proposed change.

In addition to clarifying its interpretation of ‘‘system receiver,’’ EPA is proposing to add language to § 82.156(a) to ensure that the regulations clearly preclude a possible misinterpretation of these requirements. EPA has always interpreted § 82.156(a) to require that, except in the case of non-major repairs to low-pressure appliances, liquid refrigerant must be removed from appliances (or from the isolated parts to be serviced) before they are opened to the atmosphere. Currently, § 82.156(a) reads (in part) ‘‘all persons disposing of appliances * * * must evacuate the refrigerant in the entire unit to a recovery or recycling machine certified pursuant to § 82.158. All persons opening appliances * * * must evacuate the refrigerant in either the entire unit or the part to be serviced (if the latter can be isolated) to a system receiver or a recovery or recycling machine certified pursuant to § 82.158.’’ Sections 82.156(a)(1) through (5) specify pressures to which the appliances must be evacuated.

It has come to EPA's attention that it may be possible in some cases to briefly attain the required evacuation levels specified in §§ 82.156(a)(1) through (5) while there is still liquid refrigerant in the appliance or in the isolated part to be serviced. In general, if vapor is removed from a mixture of liquid and vapor refrigerant at equilibrium, reducing the vapor pressure, the liquid will boil until the equilibrium between the vapor and liquid states is restored, returning the vapor pressure to the saturation pressure of the refrigerant. However, heat must flow into the system from the environment for this to occur, and such heat flow takes time. Thus, if an individual quickly recovers vapor from an appliance, permitting no time for the liquid to boil to return the vapor pressure to the equilibrium value, the pressure specified in § 82.156(a) may be attained, albeit only temporarily. If the individual opens the appliance at this point, a great deal of refrigerant will be released to the environment. This is because the density of liquid refrigerant is typically one to two orders of magnitude greater than that of vapor refrigerant, meaning that a large mass of refrigerant may be concentrated in a relatively small volume of liquid, and the liquid will continue to boil off into the atmosphere as long as the appliance is opened.

EPA believes that the use of the phrase ‘‘evacuate the refrigerant’’ in § 82.156(a), as well as the language in § 82.154(a) (the prohibition on venting) already clearly indicate that liquid refrigerant must be removed from the appliance or isolated part before it is opened for servicing. Otherwise, a significant portion of the refrigerant will not be evacuated to a recovery device, a good faith effort to recover and recycle refrigerant will not be made, and releases to the environment will be considerably more than de minimis. Nevertheless, to eliminate any possible ambiguity on this point, the Agency is proposing to add the phrase, ‘‘including all liquid refrigerant,’’ after the phrase, ‘‘the refrigerant,’’ in both places where it occurs in § 82.156(a). To ensure that the modified language does not implicitly override § 82.156(a)(2)(i)(B), which provides that recovery of liquid is not required in cases of non-major repairs to low-pressure appliances, EPA is proposing to add the parenthetical phrase ‘‘(except as provided at § 82.156(a)(2)(i)(B))’’ to the second occurrence of ‘‘including all liquid refrigerant.'' EPA requests comment on this proposed change.

In response to the second request for clarification, EPA believes that if a part of an appliance already meets the required level of evacuation due to normal operating characteristics, it may be isolated and opened for repairs without further evacuation, so long as liquid refrigerant is not present in the isolated part. Again, the purpose of the requirement to evacuate under § 82.156(a) is to minimize refrigerant emissions from the part. If the required level of evacuation has been met, and no liquid is present in the isolated part, only de minimis quantities of refrigerant will be released when the part is opened to the atmosphere. Therefore, this situation meets the requirements to evacuate under § 82.156(a).

2. Disposition of Recovered Refrigerant

EPA is proposing to establish purity requirements for HFCs and PFCs very similar to those for CFCs and HCFCs. In addition, the Agency is proposing to update its purity requirements for all refrigerants to reflect the most recent industry standard, ARI 700–1995, Specifications for Fluorocarbon and Other Refrigerants, and is requesting comment on adopting a generic standard of purity for those refrigerants that are not covered by ARI 700–1995.

a. Background. Currently, before being sold for use as a refrigerant, used CFCs and HCFCs must be reclaimed by a certified reclaimer to the ARI 700–1993 Standard of purity, which is codified as Appendix A to subpart F. In a separate rulemaking, EPA has proposed to add more flexibility to the purity standards for CFC and HCFC refrigerants, permitting contractors to transfer refrigerant from one customer's to another customer's equipment, so long as (1) the refrigerant remains within the contractor's constant custody and control, (2) the refrigerant is returned to the ARI 700 Standard of purity, and (3) this purity is verified through submission of a representative sample to an analytical laboratory certified by an EPA-approved laboratory certification program. That proposal would also require third party certification of reclaimers. See 61 FR 7858 (February 29, 1996).

b. Extending Purity Requirements to HFC and PFC Refrigerants. EPA is not today soliciting comment on which refrigerant purity regime is preferable for all refrigerants. Instead, EPA requests comment on whether the purity of HFCs and PFCs should be maintained through a different regulatory approach than the purity of CFCs and HCFCs, and if so, why.

EPA believes that the rationale for promulgating purity standards for CFCs and HCFCs also applies to HFCs and PFCs [21]. EPA discussed the rationale for covering CFCs and HCFCs at length in the May 14, 1993 final rule (58 FR 28678–28679), the March 17, 1995, and February 29, 1996 direct final rules, and the December 27, 1996 final rule extending the reclamation requirement (60 FR 14608, 61 FR 7724, and 61 FR 68506). In summary, the purity requirements are intended to prevent refrigerant releases that would result from refrigerant contamination, particularly releases linked to damage to equipment caused by use of contaminated refrigerant. This damage, including sludging of high-viscosity oils in low temperature systems, freezing of moisture in capillary tubes, corrosion from acids, and high head-pressures from noncondensables and refrigerant mixtures, could be caused by contaminated HFCs and PFCs (and their lubricants) as well as by contaminated CFCs and HCFCs. Equipment damage from contaminated refrigerant would result in costs to equipment owners and releases of refrigerant from damaged equipment though increased leakage, servicing, and replacement. In addition, such damage would ultimately lead to a reduction in consumer confidence in the quality of used refrigerant.

Given these potential effects, EPA believes that promulgating purity requirements for HFCs and PFCs is vital to implementation and enforcement of section 608(c)(2). Any reduction in consumer confidence in the quality of used refrigerant would undermine a fundamental incentive to comply with the section 608(c)(2) prohibition on venting substitute refrigerants. Without a market for the used refrigerant, there is no economic incentive to recover it; indeed, the costs of recovery and destruction create a significant economic incentive simply to release the substance, in violation of the venting prohibition. Moreover, the removal of economic incentives to comply with the prohibition is particularly deleterious to compliance because direct enforcement of the prohibition is difficult. The prohibition applies to numerous small entities, including over one million technicians, and EPA lacks the resources to monitor their refrigerant-related activities on an individual basis. Under these circumstances, establishing economic incentives for compliance, or at least neutralizing economic disincentives to compliance, is particularly critical to implementing the statutory prohibition on venting.

The proliferation of refrigerants and lubricants on the market has made efforts to protect refrigerant purity more important than ever. The increasing number of refrigerants increases the probability of refrigerant mixture, particularly if equipment that has been retrofitted with new refrigerant is not properly identified, leading to mixture of a CFC with the HCFC or HFC that replaced it. Requirements to analyze refrigerant before sale to a new owner can prevent mixed refrigerants from being placed into equipment or from contaminating a larger batch of refrigerant.

Moreover, EPA believes that purity standards must apply to all refrigerants in similar applications in order to ensure purity for any subset of these refrigerants. As noted above, several persons attending the March 10, 1995 public meeting stated that failure to apply standards to HFCs could erode compliance with the standards for CFCs and HCFCs, because technicians would become either confused or skeptical regarding standards that were applied inconsistently. Such standards would also be difficult to enforce. For instance, without purity standards, contractors could sell dirty HFCs on the open market, and it would be relatively easy to hide commerce in dirty CFCs or HCFCs within commerce in dirty HFCs (e.g., through deliberate mislabelling, a tactic that has been used to import CFCs illegally). Thus, purity standards for HFCs are important to prevent damage to CFC and HCFC equipment and subsequent emissions of these refrigerants as well. As a consequence, EPA believes that purity standards for HFCs and PFCs are important to implement the section 608(a)(2) requirement to reduce emissions of CFCs and HCFCs to the lowest achievable level.

EPA is proposing to extend the purity requirements to HFCs and PFCs by revising prohibitions 82.154(g) and (h) to refer simply to ''refrigerant'' rather than to ''class I and class II substances.'' In addition, EPA is proposing to include purity standards and analytical protocols for HFC refrigerants in Appendix A.

c. *Updating the Purity Standard*. EPA is proposing to adopt the most recent version of the industry purity standard and analytical protocol for refrigerants, ARI 700–1995. ARI 700–1995 includes standards for a number of refrigerants that are not addressed by the currently

[21] In finalizing the purity requirements for HFCs and PFCs, EPA will consider comments received on both on the February 29, 1996, document (and on any subsequent document related to purity standards for refrigerant) and on this document.

codified standard, ARI 700–1993. These refrigerants include R404A, R405A, R406A, R407A, B, and C, R408A, R409A, R410A and B, R411A and B, R412A, R507, R508 and R509. In addition, the Appendix C to ARI Standard 700–95 has updated some of the procedures for the analysis of refrigerants in Appendix 93 to ARI 700–1993, which is incorporated by reference into subpart F. First, methods have been added for determining the composition of the zeotropic refrigerant blend families R404, R407, R408, R409, and R410, and of the azeotropic refrigerant blends R507 and R508. These methods will enable laboratories to verify that the blends contain the appropriate percentages of their component materials. Second, a gravimetric test has been added as an alternate method for determining high-boiling residues. The gravimetric test is actually considered to be more accurate than the current volumetric method, and its addition will permit laboratories with the appropriate facilities and expertise to perform more precise measurements of high-boiling residues than are permitted by the volumetric method. (The volumetric method is retained as an alternate in ARI 700–95 because it is adequately precise for most applications, and is less expensive to perform than the gravimetric method.) Finally, several typographic and wording changes have been made to improve the clarity of the standard. EPA believes that these changes will make the reclamation requirements more enforceable while decreasing the burden of industry to prove conformance.

ARI is currently revising ARI Standard 700–95 to reflect further advances in refrigerant analysis and changes in the refrigerant market. Because the next version of the Standard may be completed between the publication of this proposed rule and the final rule, and because EPA believes it is appropriate to adopt the most recent version of the Standard possible, EPA is requesting comment on the changes to the Standard that EPA understands are being considered. These changes include (1) the adoption of a single analysis (for each blend) for determining both the composition of each refrigerant blend and its level of contamination by organic impurities, and (2) the standardization of the presently wide range of equipment, techniques, and calculations used in the current methods for determining the composition of refrigerant blends. Currently, there are no analytical methods for determining blends' levels of contamination by organic impurities, and the adoption of a standardized and consolidated composition/impurity analysis will therefore make the standard more enforceable without significantly increasing the burden on laboratories. These changes are discussed in more detail in a report developed by Integral Sciences Incorporated for the Air-Conditioning and Refrigeration Technology Institute (ARTI). This report is entitled *Methods Development for Organic Contaminant Determination in Fluorocarbon Refrigerant Azeotropes and Blends* and is included in the docket for this rulemaking.

d. Generic Standard of Purity. Despite EPA's proposed adoption of the latest industry standard, the Agency's purity standards are likely to be rendered incomplete shortly after their promulgation by the rapid development and introduction of new refrigerants into the market. In general, there is likely to be a delay between the introduction of new refrigerants and the adoption of specific purity standards for them by ARI and EPA. Although EPA plans to consider purity requirements along with recycling requirements for each new refrigerant as it undergoes SNAP review, the Agency is requesting comment on establishing a generic purity standard for refrigerants for which specific purity standards have not yet been codified. The ARI 700 standard includes specifications for boiling points, boiling ranges, isomer contents, noncondensables, water, high-boiling residue, particulates/solids, acidity, and chlorides. Except for boiling points, boiling ranges, and high boiling residues, the specifications for all CFC, HCFC, and HFC refrigerants are identical or vary systematically according to the saturation pressure of the refrigerant. EPA is requesting comment on whether HFCs for which specific standards have not been codified should be subject to the following maximum contaminant levels, which are based on those of ARI 700:

GENERIC MAXIMUM CONTAMINANT LEVELS

Contaminant	Reporting units	Low pressure refrigs.	Other refrigs.
Non-condensables	% by volume @ 25°C.	N/A	1.5.
Water	ppm by weight	20	10.
High boiling residue	% by volume	0.01	0.01.
Particulates/solids	Visually clean to pass.	pass	pass.
Acidity	ppm by weight	1.0	1.0.
Chlorides	No visible turbidity	pass	pass

EPA requests comment on the specific contaminant levels presented here.

Since reclamation requires not only that refrigerant be cleaned to a certain level, but also that it be analyzed to verify that it meets that level, a generic standard of purity should be matched by a generic analytical protocol. General analytical procedures exist to determine the levels of acidity, water, high-boiling residue, chloride, and non-condensable gases in refrigerants; these procedures are detailed in parts 1 through 5 of Appendix C to ARI 700–95. However, individual gas chromatography procedures are required for each refrigerant in order to determine the overall purity of that refrigerant. This is because each refrigerant has its own gas chromatogram (profile) and characteristic impurities (other than acid, water, high-boiling residue, chloride, and noncondensable gases). EPA understands that the need to develop gas chromatography procedures is what frequently slows the adoption of reclamation procedures for new refrigerants. Thus, EPA requests comment on whether it would be useful to have generic standards of purity for new refrigerants and analytical protocols for acid, water, high-boiling residues, chloride, and noncondensable gases for these refrigerants in the absence of specific gas chromatography procedures to determine the overall purity of these refrigerants.

e. Possible Application of Standard of Purity to New Refrigerants. EPA believes that the vast majority of new refrigerant sold meets the ARI 700 standard. However, the Agency understands that on occasion, used or otherwise contaminated refrigerant has been sold as ''new.'' In order to ensure that the Agency can prevent the sale of contaminated refrigerant that is labeled as ''new,'' EPA is requesting comment on whether it should require new refrigerant to meet the ARI 700–1995 specifications. EPA also requests comment on whether producers or sellers of new refrigerant should be required to analyze the refrigerant before its sale, using the protocol set forth in ARI 700–1995.

3. Leak Repair

EPA is proposing to lower the permissible leak rates for some air-conditioning and refrigeration equipment containing more than 50 pounds of CFC[22] and HCFC refrigerant. EPA is also proposing to extend the leak repair requirements (as they would be amended) to air-conditioning and refrigeration equipment containing more than 50 pounds of HFC and PFC refrigerant. Specifically, EPA is proposing to lower the permissible annual leak rate for new commercial refrigeration equipment to 10 percent of the charge per year, the permissible annual leak rate for older commercial refrigeration equipment to 15 percent per year, the permissible annual leak rate for some industrial process refrigeration equipment to 20 percent of the charge per year, the permissible annual leak rate for other new appliances (e.g., comfort cooling chillers) to five percent of the charge per year, and the permissible annual leak rate for other existing appliances to 10 percent of the charge per year. The proposed changes would become effective thirty days after publication of the final rule except for the provisions affecting industrial process refrigeration, which would become effective three years after publication of the final rule. The other aspects of the current leak repair provisions, such as time lines for repair or retrofit, would remain the same.

The current permissible annual leak rates for commercial and industrial process refrigeration and for other appliances are 35 percent per year and 15 percent per year respectively. These limits were set based on information that EPA gathered regarding typical leak rates for these types of equipment in 1991 and 1992. In several recent meetings and conversations with EPA, industry representatives have indicated that air-conditioning and refrigeration equipment manufactured over the past few years has been designed to leak at lower rates than air-conditioning and refrigeration equipment manufactured earlier, and that existing appliances have often been modified with new devices, such as high-efficiency purge devices for low-pressure chillers, that have significantly lowered their leak rates. Manufacturers have made these design changes, and owners have invested in them, in response to growing environmental and economic concerns associated with refrigerant emissions.

a. Comfort Cooling Chillers. EPA's research indicates that the reduction in leak rates has been most dramatic in comfort cooling chillers, where leak rates have been lowered from between 10 and 15 percent per year to less than five percent per year in many cases. Design changes that have contributed to this reduction include the installation of high-efficiency purge devices on low-pressure chillers, the installation of microprocessor-based monitoring systems that can alert system operators to warning signs of leakage (such as excessive purge run time), the use of leak-tight brazed rather than leak-prone flared connections, and the use of isolation valves, which permit technicians to make repairs without evacuating and opening the entire refrigerant circuit. The first two conservation measures can be implemented for existing as well as new equipment; the last two apply primarily to new equipment.

Manufacturers, servicers, and users of chillers state that, as a result of these modifications, new chillers (those built since 1992) typically leak less than five percent per year, with many new chillers leaking around two percent per year, and some leaking less than one percent. Only one type of new equipment has been reported to have a leak rate above five percent; that is high-pressure chillers with open-drive compressors, which have been found to have leak rates ranging from four to seven percent. Older chillers that have been modified with emissions-reduction technologies are reported to leak between one and 10 percent per year. Where industry sources have not distinguished between modified and unmodified older equipment, leak rates have been reported to average four percent per year, indicating that most of the chiller fleet has either been modified to leak less or is significantly better maintained than it was five years ago.

EPA believes that the reported performance of today's chiller fleet argues for lowering the maximum permissible leak rate from 15% per year. The leak repair requirement was promulgated under section 608(a)(2), which requires EPA to promulgate regulations regarding the use and disposal of class I and class II substances, including refrigerants, that reduce the use and emission of such substances to the lowest achievable level. EPA believes that the evidence discussed above demonstrates that the current 15-percent-per-year permissible rate is considerably above the ''lowest achievable level of emissions,'' especially for new equipment. (In fact, EPA acknowledged in the May 14, 1993 rule that the 15-percent-per-year leak rate probably was not the lowest achievable level for at least some comfort cooling equipment, but the Agency did not have sufficient information at that time to develop stricter or more refined standards.)

While section 608(a)(2) does not require EPA to perform a cost-benefit analysis to determine what leak rate(s) would constitute the ''lowest achievable level of emissions,'' such cost-benefit analyses support establishing lower leak rates. One such analysis simply deduces from achieved leak rates that a lower permissible leak rate would be publicly cost-effective. The leak rates reported above, which generally fall well below the current regulatory maximum, are clearly being achieved in response to private incentives alone. If maintaining these leak rates is privately cost-effective, it must be publicly cost-effective, because the public cost of emissions, which includes both the private value of the refrigerant and the environmental damage it causes, exceeds the private cost of emissions, which includes only the private value of the refrigerant.

In another analysis, EPA directly examined the public cost-effectiveness of certain types of leak repair and equipment modification. First, EPA estimated the public benefits of avoiding emissions of refrigerant on a per kilogram basis. Second, EPA calculated the leak reductions that would have to be achieved through repairs and modifications to produce benefits to offset their costs. In general, EPA found that reductions in leak rates on the order of two to 10 percent of the charge per year had to be achieved to justify the cost of the leak repair or equipment modification. These reductions are comparable to those that have already been achieved over the last four years through the implementation of leak repair and equipment

[22] EPA is not aware of any manufacturers of new appliances who are still using CFCs. However, in the event that such appliances were manufactured, they would be subject to the new leak repair requirements.

modification, providing additional evidence that leak rates below the current 15 percent permissible rate can be cost-effectively achieved.

Because EPA's data indicates that new chillers leak less than existing chillers, and because some leak reduction modifications can be applied to new, but not to existing, equipment, EPA is proposing a more stringent standard for new chillers than for older chillers. For chillers built in 1993 or later, EPA is proposing a maximum permissible leak rate of five percent per year. With one exception, the reported leak rates for new chillers all fall below this rate, and the exception, the open-drive type of high pressure chiller, has leak rates between four and seven percent. EPA believes that with careful maintenance, even these chillers can maintain a leak rate below five percent. However, if they cannot, EPA requests comment on whether EPA should establish a larger maximum leak rate for this type of chiller. EPA is currently disinclined to establish a special, larger rate, because EPA believes that, if necessary, chiller designs with lower inherent leak rates can be substituted for the high-pressure, open-drive type at little or no additional cost.

For chillers built in 1992 or earlier, EPA is proposing a maximum permissible leak rate of 10 percent per year. This rate is consistent with the data provided to EPA for fleets that include modified equipment. While EPA considered setting the leak rate for older equipment equal to that for new equipment, information gathered to date indicates that it may be difficult to reduce the emissions of some older equipment to much below 10 percent of the charge per year without undertaking the wholesale replacement of existing joints and seals, which would prove prohibitively expensive. EPA requests comment on the proposed leak rates for both new and existing equipment.

Finally, EPA requests comment on whether there are any appliances that would be classified as ''Appliances other than commercial or industrial process refrigeration'' that are not comfort cooling chillers and that could not attain the five and 10 percent per year maximum permissible leak rates that are being proposed for new and existing appliances of this type. EPA currently believes that the vast majority, if not all, of the appliances classified as ''Appliances other than commercial or industrial process refrigeration'' are comfort cooling chillers and can attain the proposed rates.

b. Commercial Refrigeration. In general, leak rates are higher in the commercial refrigeration sector than in the chiller sector. In large part, this is attributable to the facts that (1) equipment in the commercial refrigeration sector is largely assembled in the field (in the grocery store or food storage warehouse) rather than in the factory and (2) commercial refrigeration equipment generally uses a long single refrigerant loop for cooling rather than a short primary refrigerant loop with a secondary loop containing water or brine. The first fact makes it more difficult for original equipment manufacturers to systematically implement leak reduction technologies for commercial refrigeration equipment than for chillers (in fact, in a sense, each of the hundreds of contractors who install the equipment nationwide is a ''manufacturer''), and the second tends to raise average leak rates, particularly when the refrigerant loop flows through inaccessible spaces, such as underneath floors. In addition to these considerations, the need to operate commercial refrigeration equipment continuously to keep products from spoiling makes leak repair more difficult.

Nevertheless, data from manufacturers and owners of commercial refrigeration equipment indicates that leak rates considerably lower than 35 percent per year can be achieved cost effectively with this equipment. A study sponsored by EPA's Office of Research and Development analyzed two detailed bodies of data on leakage from commercial refrigeration equipment, one collected by a Midwestern chain of 110 stores and the other gathered by the South Coast Air Quality Management District (SCAQMD), which requires monitoring and reporting of leak rates from large refrigeration systems. The Midwestern chain achieved an average leak rate of 15 percent by establishing written procedures for equipment installation (including a requirement that expansion valves be brazed or ''sweated''), a refrigerant monitoring system, and an equipment inspection protocol. This rate was achieved in 1992, before EPA's leak repair requirements were even in effect. The data collected by SCAQMD was based 440 recharging and leak testing events from 56 different stores representing 20 different businesses. The average leak rate achieved by the stores was eight percent of total charge.

The ORD report also investigated the cost-effectiveness of different strategies and technologies for reducing leak rates, finding that many of these approaches could lower leak rates significantly and thereby pay for themselves. Using a combination of these approaches, a number of chains had significantly reduced both overall refrigerant consumption and leakage from equipment over the previous two to eight years. Some of the most effective approaches included vibration elimination devices, use of high-quality brazed rather than mechanical connections, low emission condensers, stationary leakage monitors, refrigerant tracking and improved preventive maintenance. A few of the approaches, such as installation of low-emission condensers, were more applicable to new than to existing equipment; however, many of the approaches, such as refrigerant monitors, refrigerant tracking systems, and improved preventive maintenance, were applicable to both existing and new equipment. These approaches were individually expected to reduce leak rates from equipment by between five and forty percent of the charge per year.

In light of this information, EPA is proposing to establish lower permissible leak rates for commercial refrigeration equipment. Although neither the Midwestern chain nor SCAQMD distinguished between new and old equipment in measuring leak rates, equipment manufacturers (ARI) have stated that leak rates in new equipment are likely to be lower than leak rates in old equipment. This statement, along with the fact that some leak reduction technologies are applicable to new but not to older equipment, indicates that it would be appropriate to establish different permissible leak rates for new and old commercial refrigeration equipment. EPA is therefore proposing that the maximum permissible leak rate for new commercial refrigeration equipment (commissioned after 1992) be lowered to 10 percent per year, and that the maximum rate for old commercial refrigeration equipment (commissioned before or during 1992) be lowered to 15 percent per year. EPA believes that these rates are appropriate in view of the average leak rates achieved in the South Coast Air Quality Management District and in the Midwestern chain and in view of the availability of effective leak reduction approaches.

EPA requests comment on these proposed rates. First, EPA requests comment on whether the relatively low leak rates observed in new equipment are likely to persist throughout its lifetime, or whether those rates are likely to rise over its lifetime to approach the current leak rates of older equipment. In other words, does new equipment leak less simply because it has endured less wear and tear than older equipment, or is new equipment now manufactured and installed in a way that will minimize leakage over its entire life? Second, EPA requests comment on whether higher or lower rates might be appropriate for different types of commercial refrigeration equipment, given that compressor rack systems, single compressor systems, and self-contained units may have significantly different average leak rates. For instance, because compressor rack systems may include miles of piping and numerous connections that provide many opportunities for leakage, one might expect them to leak a greater percentage of their charge than self-contained units that include only a few feet of piping. Third, EPA requests comment on whether significant percentages (e.g., 10 percent or more) of the various types of commercial refrigeration equipment might not be able to comply with leak rates of 10 or 15 percent without being totally replaced, and, if this is the case, whether permissible leak rates of 15 and 20 percent might be more achievable.

c. Industrial Process Refrigeration. As is the case for commercial refrigeration equipment, leak rates in industrial process refrigeration equipment have been falling, but the rates and consistency of decline across equipment types have been lower than for comfort cooling chillers. While some industrial process refrigeration equipment has attained leak rates between five and 10 percent per year, other equipment has continued to leak near the 35-percent-per-year maximum permissible rate despite the growing price of refrigerants over the past five years. The conditions that contribute to a wide range of leak rates in the commercial refrigeration sector apply even more to the industrial process refrigeration sector. Equipment in the industrial process refrigeration sector is not only assembled on site, but is often custom-designed for a wide spectrum of processes and plants, giving the sector an extraordinarily broad range of equipment configurations and designs. Equipment may be high- or low-pressure; may possess hermetic, semi-hermetic, or open-drive compressors; may use one (primary) or two (primary and secondary) refrigerant loops; may be brand new or decades old; and may range in charge size from a few hundred to over 100,000 pounds of refrigerant. All of these factors are important in determining leak rates, leading to the observed range mentioned above.

Specifically, as is true for chillers, and, to some extent, for retail food refrigeration equipment, industrial process refrigeration equipment built more recently has generally been designed to leak less than equipment built earlier. Similarly, equipment containing hermetic compressors tends to leak less than equipment containing open-drive compressors, because the latter possess openings for their drive shafts, compromising the integrity of the system. Single loop, direct expansion systems tend to leak more than systems possessing a secondary water or brine loop because the former tend to have longer refrigerant loops than the latter, increasing opportunities for leakage. Large equipment may leak more than small equipment for two reasons. First, large equipment tends to be custom-built rather than built on an assembly line in a factory, making it more difficult to regulate manufacturing techniques (joint construction, etc.) that affect leakage. Second, large equipment tends to have more piping and joints than small equipment, increasing the number of potential leak sites.

EPA believes that it is appropriate to consider the date of manufacture, compressor configuration, and possession (or lack) of a secondary loop in determining maximum allowable leak rates for industrial process refrigeration equipment. However, the Agency is reluctant to permit higher leak rates for equipment with very large charge sizes. This is because a given leak rate in large equipment causes more environmental harm than the same leak rate in small equipment. For example, a 20% per year leak rate in equipment with a 10,000 pound charge would result in the release of 2,000 pounds of refrigerant per year, while a 20% per leak rate in equipment with a 1,000 pound charge would result in the release of 200 pounds of refrigerant per year. Thus, although it may be more difficult or expensive to achieve a given leak rate in large equipment than in small equipment, EPA believes that these additional efforts are warranted by the larger environmental impact of leaks from large equipment.

In view of these considerations, EPA is proposing different maximum permissible leak rates based on the equipment's date of manufacture, compressor configuration, and number of refrigerant loops (primary only vs. primary and secondary). EPA thereby expects to increase environmental protection (by lowering the permissible rate where it can be lowered) without imposing undue costs (by accommodating types of equipment for which the rate cannot be lowered). At the same time, however, the Agency wishes to minimize the confusion that might be associated with having multiple permissible rates that are keyed to different combinations of the above criteria. EPA is therefore is proposing a two-rate system for the industrial process sector. As is the case for the comfort cooling and commercial refrigeration sectors, EPA believes that these changes are necessary to carry out section 608(a)(2) of the Act.

Under the proposed approach, industrial process refrigeration equipment would be subject to a 20 percent per year maximum permissible leak rate unless it met all four of the following criteria:

(1) The refrigeration system is custom-built;

(2) The refrigeration system has an open-drive compressor;

(3) The refrigeration system was built in 1992 or before; and

(4) The system is direct-expansion (contains a single, primary refrigerant loop).

Systems that met conditions 1, 2, 3, and 4 would continue to be subject to the 35-percent-per-year maximum permissible leak rate.

The Agency requests comment on the approach, both on the criteria used to sort equipment between the 20% and 35% per year rates, and on the rates themselves. EPA specifically requests comment on whether it might be appropriate to permit a higher leak rate for equipment with a charge size above 10,000 lbs. As noted above, EPA is reluctant to permit higher leak rates for large equipment due to the greater environmental impact of a given leak rate from large equipment; however, if it is demonstrably impossible to reduce the leak rate of such equipment without undertaking a massive overhaul, EPA could consider permitting a higher leak rate for large equipment built before 1992. The Agency believes that large equipment built more recently should be able to maintain a leak rate of 20% per year. The Agency also requests comment on whether it would be appropriate to use a measure other than charge size to characterize sprawling, inherently leaky equipment. The Agency is concerned that the proposed characterization might inappropriately permit high leak rates for some large equipment that does not possess an inherently leaky configuration. One alternative would be to use pipe length rather than charge size to characterize equipment as having a leaky configuration.

In addition, EPA requests comment on the interchangeability of leaky and non-leaky equipment designs. That is, are there compelling reasons why users of industrial process refrigeration must use open-drive compressors or direct expansion systems rather than hermetic compressors and secondary loops? The Agency understands that it may be difficult to transform an existing direct expansion system into a system with a secondary loop. However, persons installing new systems might be expected to have more flexibility.

Other possible approaches to leak repair in industrial process refrigeration equipment could be either more or less complex than the one proposed. A simple approach would lower the current permissible leak rate for all industrial process equipment to a single new rate, perhaps to 25 percent per year. While this approach would be administratively simple, however, it could be costly if a significant fraction of existing equipment was not able to meet the new rate without massive overhaul or replacement. Based on its discussions with users of industrial process refrigeration equipment, EPA believes that this is indeed the case. A more complex approach would establish three or more permissible rates for different classes of equipment based on the above criteria. However, although this approach would better tailor permissible leak rates to the inherent leak rates of different types of equipment, the Agency believes that any environmental or economic gains that might be achieved through such an approach would not justify its complexity and associated difficulty of implementation. EPA requests comment on these potential alternative approaches.

EPA is proposing to make the new leak rates effective for industrial process refrigeration equipment three years after promulgation of this rule. EPA is proposing this delayed effective date for industrial process refrigeration equipment for several reasons. First, the current leak repair requirements for industrial process refrigeration equipment only became effective in September 1995, over two years later than the leak repair requirements for other equipment. Owners and servicers of industrial process refrigeration equipment have therefore had considerably less time than owners and servicers of other types of equipment to learn and implement the existing maximum permissible rates. Thus, promulgating new maximum permissible rates with immediate effective dates would lead to considerable confusion and disruption in this sector, while, inversely, promulgating new rates with delayed effective dates would permit this sector to make an orderly transition between the old and new rates. Second, because it is custom-built, industrial process refrigeration equipment takes longer than other types of equipment to build and to repair. The proposed lead time between promulgation and effective date would permit equipment users sufficient time to order replacement parts or systems that might be necessary to meet the new rates. Finally, industrial processes must be shut down, at considerable expense, before large repairs can be made to their refrigeration systems or before such systems can be replaced. According to industry sources, shutdowns are usually only scheduled to occur every two to five years. Again, this argues for permitting significant lead time between the promulgation and effective date of the new leak rate. EPA requests comment on its proposed three-year delay.

d. Cross-sector Issues. EPA is also requesting comment on four issues that affect all three sectors covered by the leak repair requirements. First, EPA requests comment on its proposal to distinguish between old and new equipment in establishing maximum allowable leak rates. In general, the Agency believes that equipment manufactured after 1992 is, by a significant margin, inherently more leak-tight than equipment manufactured before that date. This means that significantly lower leak rates can be maintained in new equipment than in old equipment for about the same cost. If EPA were to set a single allowable leak rate for old and new equipment, this rate would probably be either difficult to attain in old equipment, forcing the expensive retrofit or replacement of the equipment, or above the rate achievable by new equipment, permitting emissions significantly above the lowest achievable level. However, EPA recognizes that implementing two leak rates for each type of equipment would be more administratively complex than implementing a single leak rate for each type of equipment. To implement two leak rates, equipment owners, operators, and technicians would have to remember both rates, and they would have to be able to distinguish old from new equipment. Based on current information, EPA does not believe this would constitute an unreasonable burden or lead to excessive confusion. However, the Agency requests comment on whether the environmental and economic benefits of having two leak rates justify the increase in administrative complexity that results from this approach.

Second, if the final regulations distinguish among appliances based on their dates of manufacture, EPA requests comment on whether the date of ‘‘manufacture’’ should be defined as the date that appliance leaves the factory or the date that it is installed. The Agency believes that it may be appropriate to define ‘‘manufacture’’ differently for different types of appliances. Appliances that are relatively compact and complete when they leave the factory, such as chillers, could be considered ‘‘manufactured’’ when they leave the factory, while appliances that are assembled in the field from numerous components, such as commercial and industrial process refrigeration equipment, could be considered ‘‘manufactured’’ (or ‘‘commissioned’’) when their installation is complete.

Third, EPA requests comment on the proposed use of the year 1992 as the dividing line between more and less strictly regulated equipment. EPA's research indicates that by the end of that year, most equipment was being manufactured to leak significantly less than equipment built earlier. However, if a significant fraction of equipment manufactured since 1992 still cannot attain the proposed maximum leak rate, it may be appropriate to make the stricter requirements effective for equipment built after 1999 (or whatever year follows the year of publication of the final rule). This would permit equipment purchasers to consider the leakiness of certain types of equipment in their purchasing decisions from now on, allowing for the lag time between equipment ordering and manufacture.

Fourth, EPA requests comment on whether it is possible to distinguish between slow leakage, servicing emissions, and catastrophic emissions in establishing and complying with leak rate limits. This question becomes important with a lower permissible leak rate because the percentage of charge lost through servicing and catastrophic emissions may be a significant fraction of the lower rate. The goal of the leak repair provisions has primarily been to reduce emissions from slow leakage, because servicing emissions are addressed by the rule's recycling requirements and catastrophic emissions (such as those resulting from the triggering of a pressure relief valve) are often beyond the control of equipment owners. Thus, if possible, EPA would like to establish a leak rate based on slow leaks alone. Even if it is not possible to isolate slow leaks from all other types of emissions, EPA would like to avoid establishing a relatively high permissible leak rate based in part on servicing or catastrophic emissions if it is possible to distinguish either one of these types of emissions from slow leaks. On the other hand, the Agency would like to avoid establishing an overly stringent leak rate based on hypothetical emissions from slow leaks if in practice these cannot be distinguished from other types of emissions.

Based on information gathered to date, EPA believes that servicing emissions and slow leakage may be difficult to separate, since the precise amount of refrigerant lost from equipment may not be known until the equipment is recharged after servicing. However, EPA believes that it should be possible to distinguish between catastrophic and slow emissions. Catastrophic losses will generally come to the attention of equipment owners very quickly after they occur and will be large (for the piece of equipment that experiences a catastrophic loss) compared to losses from slow emissions. Moreover, because correcting the conditions that led to the catastrophic release (e.g., correcting the conditions that led to an over-pressure situation) would be considered to repair the ''leak,'' catastrophic losses would not be expected to compromise compliance with the permissible leak rate. Based on discussions with persons who maintain chillers, EPA believes that catastrophic losses are greater than servicing losses for these appliances. EPA has less information on the relationship between catastrophic losses and servicing emissions for commercial and industrial process refrigeration equipment.

EPA requests comment on whether its understanding of the separability and relative significance of the various types of emissions is correct. EPA also requests that, to the extent possible, commenters distinguish between servicing emissions, catastrophic losses, and losses from slow leaks in their comments on what leak rates are achievable.

e. Coverage of HFC and PFC Appliances. EPA believes that establishing consistent leak repair requirements for CFC, HCFC, HFC, and PFC appliances is necessary to minimize emissions of all four types of refrigerants. As noted above, industry representatives emphasized that exempting HFC and PFC refrigerants from conservation requirements could lead to confusion and skepticism regarding similar requirements for CFCs and HCFCs, which would undermine implementation of the statutory directives to reduce emissions of these substances to the lowest achievable level and to maximize their recapture and recycling. For instance, if owners or operators of refrigeration systems could permit HFC systems to leak, they might fail to establish or maintain leak repair procedures or systems for any of their refrigeration equipment, including CFC or HCFC systems (particularly if these were in the minority at a given site), forgetting or never realizing that the latter were subject to repair requirements. Moreover, in any given application, there is no technological difference between CFC, HCFC and HFC appliances that makes leaks easier to control for one type of refrigerant than the other. Technology and techniques developed to reduce CFC and HCFC emissions can be easily applied to reducing HFC and PFC emissions. Finally, the release of all four types of refrigerants could pose a threat to the environment. EPA is therefore proposing requirements for CFC, HCFC, HFC, and PFC appliances that recognize the design and maintenance advances of the last few years.

f. Clarification of Current Requirements. i. Compliance Scenarios

The initial final rule (May 14, 1993, 58 FR 28660) required owners and operators to ''have all leaks repaired'' where an appliance subject to the leak repair requirements was leaking above the applicable allowable annual leak rate (58 FR 28716). In a subsequent rulemaking regarding leak repair requirements published August 8, 1995 (60 FR 40420), EPA amended that language to state that ''repairs must bring the annual leak rate to below 35 percent of the total charge during a 12-month period'' (60 FR 40440) or where appropriate, to below 15 percent. This change in the rule recognizes that appliances without hermetically sealed refrigerant circuits should not be expected to have a ''zero'' leak rate. Moreover, EPA also believes that it is practical to require the owners or operators to maintain a leak rate that is at or below the applicable allowable annual rate, and where this leak rate has been exceeded, to make the necessary repairs to return the appliance's leak rate to or below the applicable allowable leak rate or to retrofit/retire the appliance. Leaving leaks unrepaired does not necessarily equate to non-compliance; however, maintaining a leak rate above the maximum leak rate of either 15 or 35 percent is non-compliance.

For industrial process refrigeration equipment and for federally-owned commercial refrigeration equipment and federally-owned comfort cooling appliances located in areas subject to radiological contamination, EPA requires owners and operators to perform verification tests to establish that repairs were successful. EPA recognizes that verification tests indicate the success or failure of the repair effort for a given leak or set of leaks, not the leak rate of an appliance. In the August 8, 1995 rulemaking, EPA stated that it was not the Agency's ''intention to imply that the verification test shows what the leak rate is. However, EPA believes that where the verification test shows that the repairs have been successful, in most cases this will mean that there has been a reduction in the leak rate'' (60 FR 40430). EPA recognizes that knowing a leak has been repaired does not necessarily mean that the owner or operator knows what the current leak rate is. EPA further stated that ''if more than one leak exists, it is possible that the leak rate could remain above acceptable levels. In such cases the owners or operators would be expected to take reasonable actions'' (60 FR 40430). EPA believes that where owners or operators employ sound professional judgement in responding to a leak rate above the applicable allowable annual leak rate they will reduce the appliance's leak rate to below the applicable allowable annual leak rate.

Section 82.156(i) requires owners or operators to conduct repair efforts to lower an appliance's leak rate to below the applicable allowable annual leak rate. EPA is describing the following scenarios to assist the owners or operators in determining what actions must be taken when an appliance is leaking above the applicable allowable annual leak rate. EPA believes that by describing four likely scenarios, EPA can further clarify for the regulated community how the leak rate and verification tests relate to the repair and/or retrofit/retire provisions promulgated at § 82.156(i).

In the first scenario, the owner or operator discovers that the appliance is leaking above the applicable allowable annual rate. The owner or operator fixes all leaks and verifies that the leaks have been repaired consistent with § 82.156(i). Therefore, where sound professional judgement has been successfully executed, the appliance will have a leak rate below the applicable allowable annual rate. If a leak rate above the applicable allowable annual rate is again suspected a short time after the repairs were completed (perhaps only a few weeks) and leaks are discovered at a new location, these leaks would be considered new leaks. The owner or operator must comply with all applicable requirements promulgated at § 82.156(i) for these new leaks.

In the second scenario, the owner or operator discovers that the appliance is leaking above the applicable allowable annual leak rate. The owner or operator fixes the leaks and verifies that they have been repaired consistent with § 82.156(i). Therefore, the owner or operator believes the appliance is not leaking above the applicable allowable annual leak rate. The next time leaks are suspected, the owner or operator finds leaks have occurred at the same location. Since the initial leaks were repaired and properly verified consistent with the regulation, leaks at the same location would be considered new leaks. If the leak rate is again above the applicable allowable annual leak rate, the owner or operator must repair the leaks and, where appropriate, perform verification tests, retrofit the appliance, or retire the appliance consistent with the requirements promulgated at § 82.156(i). However, if repeated leaks continue to occur at the same location, this ongoing problem may be an indication that appropriate repairs have not actually been conducted. For example, the particular leak point may involve the connection of two parts that appears to have loosened. Rather than repeatedly tightening the connection, the parts may need to be replaced. EPA believes that where leaks at the same location continue to occur, the owner or operator may not have used sound professional judgement in determining what repair efforts are necessary to reduce the leak rate to below the applicable allowable annual leak rate. Thus, the owner or operator would have violated with the requirements in § 82.156(i).

In the third scenario, the owner or operator discovers that the appliance is leaking above the applicable allowable annual rate and identifies ten different leak sources that are contributing to the high leak rate. The owner or operator determines that repairing six leaks will bring the appliance into compliance by lowering the leak rate to below the applicable allowable annual rate. The owner or operator believes that leaving four leaks unrepaired still will result in a leak rate below the applicable allowable annual rate. The owner or operator fixes and verifies that these six leaks have been repaired consistent with the requirements promulgated at § 82.156(i). The appliance continues to leak, but below the applicable allowable annual rate. In this scenario the owner or operator of the appliance complied with the requirements by actually reducing and maintaining a leak rate that is below the applicable allowable annual rate.

In the fourth scenario, the owner or operator discovers that the appliance is leaking above the applicable allowable annual rate. The owner or operator identifies ten different leak sources that are contributing to the leak rate. The owner or operator decides that repairing six leaks will bring the appliance into compliance by lowering the leak rate to below the applicable allowable annual rate. The owner or operator fixes and verifies that these leaks have been repaired consistent with the requirements promulgated at § 82.156(i). Upon later inspection, it is discovered that the appliance continued leaking above the applicable allowable annual rate and there are no newly identified leak sources. In this scenario the owner or operator never brought the leak rate below the applicable allowable leak rate, and hence violated § 82.156(i), regardless of whether the owner or operator exercised sound professional judgement in deciding upon the leaks to be repaired.

EPA views the above scenarios as consistent with the current regulatory requirements. Therefore, today's action does not propose any regulatory changes associated with these scenarios. Nevertheless, EPA requests comment on the guidance presented for these four scenarios.

ii. Recordkeeping for leak repair. EPA received information from CMA indicating that the recordkeeping and reporting requirements promulgated at § 82.166(n) may be confusing for those subject to the requirements. EPA notes that the structure of these provisions did change between the proposed and final notices (January 19, 1995, 60 FR 3992, and August 8, 1995, 60 FR 40420) to ensure that the format was consistent with the requirements established by the Office of the Federal Register. The August 8, 1995 final rule requires the same information to be maintained or submitted as EPA proposed in the January 19, 1995, except as discussed in the preamble to the August 8, 1995 final rule.

CMA and its members requested that EPA consider whether these provisions could be redrafted for clarity. EPA agrees that the readability of these provisions can be improved. Therefore, EPA is proposing to modify the presentation of the requirements to more clearly indicate what records must be kept and what information must be reported. EPA is not proposing any changes in the substance of the requirements. EPA requests comment on these proposed changes and whether they improve readability of the provisions.

iii. Replacement refrigerants. EPA is proposing to amend § 82.156(i)(6) to incorporate a requirement that was discussed in the preamble to the May 14, 1993 initial final rule (58 FR 28680) but that was inadvertently excluded from the regulatory text. In the preamble, EPA indicated that if the owners or operators elect to retrofit an appliance rather than repair leaks that are above the applicable allowable annual rate, the owners or operators must use a refrigerant with a lower ozone-depleting potential (ODP) than the original refrigerant. Owners and operators would still retain the options of either retiring the appliance or repairing the existing leaks in accordance with the existing requirements. EPA refers readers to the preamble discussion in the May 14, 1993 rule for additional information. EPA believes this proposed change is important to minimize the use of refrigerants that are potentially more harmful to stratospheric ozone. It would be environmentally unsound to exempt owners or operators from repairing leaks on the grounds that they will retrofit or replace the leaky appliance if the replacement refrigerant would pose an equivalent or even greater threat to the stratospheric ozone. Therefore, EPA is today proposing to modify the regulatory text to ensure that only a substitute refrigerant with a lower ODP is used. EPA requests comment on this proposed regulatory change.

iv. Minor Clarifications. EPA is proposing to modify the text throughout § 82.156(i) and § 82.166(n) and (o) to substitute the word ''retire'' for the word ''replace'' and to add ''operators'' where the regulation inadvertently refers solely to owners. EPA believes these changes are necessary because the term ''retire'' better describes the activities that are discussed and because the requirements are applicable to both owners and operators.

EPA is also proposing to modify § 82.156(i)(3), which requires owners and operators to exercise sound professional judgement and to perform verification tests, to clarify that it applies to all owners and operators of industrial process refrigeration equipment and not just to those who are granted additional time under paragraph (i)(2). At the same time, EPA is proposing to clarify that the paragraph applies to owners and operators of federally-owned commercial refrigeration equipment and of federally-owned comfort cooling appliances who are granted additional time under paragraphs (i)(1) and (i)(5). In the preamble to the August 8, 1995 rule, EPA stated that initial and follow-up verification tests must be performed even where the repairs are completed within 30 days (60 FR 40430). EPA inadvertently neglected to make the corresponding change to the regulatory text. Therefore, EPA is proposing to change the first sentence in the paragraph to the following: ''Owners or operators of federally-owned commercial refrigeration equipment or of federally-owned comfort cooling appliances who are granted additional time under paragraphs (i)(1) or (i)(5) of this section, and owners or operators of industrial process refrigeration equipment, must have repairs performed in a manner that sound professional judgment indicates will bring the leak rate below the applicable allowable leak rate.''

In addition, EPA is proposing to amend § 82.156(i)(3)(ii) and (i)(6)(i) to provide owners and operators 30 days to prepare and 1 year to execute a retrofit/ retirement plan, where the owners or operators have unsuccessfully attempted to repair the appliance and therefore are switching to a retrofit/ retirement mode. Section 82.156(i)(3)(ii) permits owners and operators who are unable to verify that repairs have been successful to switch to a retrofit/ retirement mode. EPA is proposing to delete from this paragraph the phrase ''* * * of this section within one year after the failure to verify that repairs had been successfully completed.'' This phrase starts the one-year retrofit/ retirement implementation clock based on the date of the failed verification test. EPA provided this provision because the Agency believes it is appropriate to permit the owner or operator of industrial process refrigeration equipment that fails a follow-up verification test to complete a retrofit within approximately one year of that failed test in situations where the owner or operator made good faith efforts to repair an appliance before deciding to switch to a retrofit or retirement mode.

However, in establishing this provision, EPA was concerned with the potential to abuse such a safeguard. Owners and operators who realize that a retrofit or retirement is necessary could attempt to repair the appliance while knowing such efforts were useless, merely to extend the date by which a retrofit or retirement must be completed. In an effort to limit abuse in this situation, the current regulations provide that the one-year time frame to complete a retrofit or retirement is triggered by the date of the failure to verify successful repairs. However, concerns have been raised regarding whether this limited time frame inadvertently increases the burden for those that made good faith efforts to repair the appliances, by lessening the retrofit/retirement clock by up to 30 days. In addition, those who intentionally violate the spirit of this good faith provision still could seek some extra time by pursuing useless repairs, albeit 30 days less than what is potentially available under the current regulations.

While EPA does not believe this 30-day difference imposes a significant burden under the current regulations, EPA recognizes the need to provide the owners or operators with sufficient time to develop and implement retrofit or retirement plans. Therefore, EPA is proposing to eliminate the reference to the date of the failure to verify that repairs have been successfully completed. By deleting this reference, owners or operators would have 30 days from the failure to verify that the repairs were successful to develop a retrofit/ retirement plan, and one year from the plan's date to complete the retrofit or retirement, or such longer time periods as may apply under 82.156(i)(7) and (i)(8). EPA requests comment on these proposed changes.

EPA is proposing to make several other minor clarifying changes to the regulatory text. EPA is proposing changes at §§ 82.156(i)(1), (i)(2), (i)(3)(i), (i)(5), (i)(6)(i) and 82.166(o)(10)(i) and (ii). At §§ 82.156(i)(1), 82.156(i)(2) and 82.156(i)(5) EPA is proposing to express maximum allowable leak rates in terms of the proposed defined term, ''leak rate.'' EPA believes that these changes would make the regulatory text more easily understood. In various sections of the regulations, EPA is proposing a number of minor non-substantive wording changes to make the regulatory text clearer and easier to read. None of these additional modifications should affect the meaning of the regulatory text.

EPA requests comments on these proposed changes regarding whether the changes will improve the clarity and readability of the regulatory text.

4. Proposed Changes for Servicing of MVAC-like Appliances

a. Background. MVAC-like appliances are open-drive compressor appliances used to cool the driver's or passenger's compartment of non-road motor vehicles, such as agricultural or construction vehicles. MVAC-like appliances are essentially identical to motor vehicle air conditioners (MVACs), which are subject to regulations promulgated under section 609 of the Act. However, because MVAC-like appliances are contained in non-road vehicles, they are subject to regulations promulgated under section 608 of the Act.

Due to the similarities between MVACs and MVAC-like appliances in design and servicing patterns, EPA has established requirements regarding the servicing of MVAC-like appliances that are very similar to those for MVACs (58 FR 28686). In fact, many of the section 608 requirements for MVAC-like appliances that are published at subpart F simply refer to the section 609 requirements for MVACs that are published at subpart B. For instance, § 82.156(a)(5) states that persons who open MVAC-like appliances for maintenance, service, or repair may do so only while ''properly using,'' as defined at § 82.32(e), recycling or recovery equipment certified pursuant to § 82.158(f) or (g) as applicable. The definition of ''properly using'' appears in the regulations published at subpart B, and the reference therefore subjects MVAC-like appliances to the evacuation and refrigerant purity requirements of subpart B. Similarly, the equipment and technician certification provisions applicable to MVAC-like appliances in subpart F (§§ 82.158(f) and 82.161(a)(5)) refer to the equipment and technician certification provisions applicable to MVACs in subpart B (§§ 82.36(a) and 82.40).

The section 609 and 608 regulations treat MVACs and MVAC-like appliances (and persons servicing them) slightly differently in four areas. First, persons who service MVACs are subject to the section 609 equipment and technician certification requirements only if they perform ''service for consideration,'' while persons who service MVAC-like appliances are subject to the section 608 equipment and technician certification requirements regardless of whether they are compensated for their work.[23] Second, persons who service MVACs must have a piece of recovery and recycling equipment available at their place of business, even if they never open the refrigeration circuit of the MVACs (e.g., if they only perform top-offs). In contrast, persons who service MVAC-like appliances are required to have a piece of recovery and recycling equipment available at their place of business only if they open the appliances (i.e., perform work that would release refrigerant to the environment unless the refrigerant were recovered previously). Third, recycling and recovery equipment that is intended for use with MVACs and that was manufactured before the effective date of the section 609 equipment certification provisions must be demonstrated to be ''substantially identical'' to certified recycling equipment, while recycling and recovery equipment that is intended for use with MVAC-like appliances and that was manufactured before the effective

[23] Note that persons servicing MVACs are subject to the section 608 vending prohibition regardless of whether they are compensated for their work.

date of the section 608 equipment certification provisions must simply be able to pull a 4-inch vacuum. Finally, persons servicing MVAC-like appliances have the option of becoming certified as Type II technicians instead of becoming certified as MVAC technicians under subpart B. The first three differences arise from differences between the statutory requirements of sections 608 and 609; the last is intended to give persons who service MVAC-like appliances flexibility in choosing the type of training and testing most appropriate to their work.

b. Recent Amendments to Subpart B. In a final rule published on December 30, 1997 (62 FR 68025), EPA made several changes to the provisions governing servicing of MVACs and MVAC-like appliances (as they are currently defined) at subpart B. First, EPA extended the regulations to MVACs containing substitutes for CFC and HCFC refrigerants. Second, EPA explicitly allowed mobile servicing of MVACs and MVAC-like appliances. That is, technicians are permitted to transport their recovery or recycling equipment from their place of business in order to recover refrigerant from an MVAC or MVAC-like appliance before servicing it. Third, EPA permitted refrigerant recovered from disposed MVACs or MVAC-like appliances to be reused in MVACS or MVAC-like appliances, as long as the refrigerant was processed through approved refrigerant recycling equipment before being charged into the MVAC to be serviced.

Fourth, EPA adopted new standards for recycling and recovery equipment intended for use with MVACs. These new standards address HFC-134a recover/recycle equipment, HFC-134a recover-only equipment, service procedures for HFC-134a containment, purity of recycled HFC-134a, recover/recycle equipment intended for use with both CFC-12 and HFC-134a, and recover-only equipment designed to be used with any motor vehicle refrigerants other than CFC-12 and HFC-134a. Please refer to the December 30, 1997, final rule for a detailed explanation and justification of these changes for MVACs.

As noted above, these regulations apply both to MVACS containing all types of refrigerant and to MVAC-like appliances containing class I and class II substances. As is discussed at length in the final amendment to subpart B, EPA believes that it is appropriate to cover both MVACs and MVAC-like appliances under the subpart B regulations, although EPA is relying on section 608 authority to cover MVAC-like appliances. In brief, the rationale for this approach is that (1) MVACs and MVAC-like appliance are very similar, and the requirements for MVAC-like appliances under the subpart F regulations have historically referred back to the requirements for MVACs under subpart B, and (2) MVACs and MVAC-like appliances are often serviced by the same group of people, and therefore publishing the requirements for both MVACs and MVAC-like appliances in the same place will minimize confusion within this group. Under this approach, most of the provisions governing MVAC-like appliances have been reproduced in the regulations at subpart B and will be removed from the regulations at subpart F; an important exception is the definition of MVAC-like appliance, which will remain in the regulations at subpart F. Thus, the final subpart B rule covers MVAC-like appliances as they are currently defined in the subpart F regulations, which means MVAC-like appliances containing CFCs or HCFCs. (However, the subpart B amendment does not affect the four differences between the treatment of MVACs and MVAC-like appliances identified above.)

c. Today's Proposal. In this document, EPA is proposing to change the definitions of ''appliance,'' ''MVAC-like appliance'' (which is based on the definition of ''appliance''), and ''opening'' in subpart F to include substitute refrigerants. This would effectively apply the major requirements of the amended subpart B regulations (when this rule was finalized) to MVAC-like appliances containing substitutes for CFCs and HCFCs. EPA is also proposing editorial changes to eliminate redundancy between the subpart B and subpart F rules in their treatment of MVAC-like appliances.

EPA believes that in order to implement the venting prohibition, it is necessary to apply the major subpart B requirements (including the requirements to properly use recycling and recovery equipment and to certify recycling and recovery equipment and technicians) to MVAC-like appliances containing substitute refrigerants. The basic rationale for applying the subpart B requirements to MVAC-like appliances containing substitute refrigerants is the same as that for applying the equivalent subpart F requirements to other appliances containing substitute refrigerants; this reasoning is presented throughout this document. In the case of MVAC-like appliances, however, the similarities in design and servicing patterns between MVACs and MVAC-like appliances make it appropriate to subject MVAC-like appliances to the required practices and certification programs established for MVACS in subpart B rather than to the required practices and certification programs established for stationary appliances in subpart F. (As noted above, the argument for parallel coverage of MVACs and MVAC-like appliances was discussed at length in the May 14, 1993 rule at 58 FR 28686.) EPA requests comment on the regulatory approach and rationale presented here.

C. Equipment Certification

The final rule published on May 14, 1993 requires that refrigerant recycling and recovery equipment manufactured after November 15, 1993, and used to service appliances containing CFCs or HCFCs be tested by an EPA-approved laboratory to ensure that it meets certain performance standards. These standards vary among equipment used to service MVAC-like appliances, small appliances, and other appliances. EPA is proposing to require that equipment used to service appliances containing HFCs and PFCs be tested by an EPA-approved laboratory to the same standards as apply to equipment used to service appliances containing class I and class II refrigerants, as applicable. Because EPA is simultaneously proposing to permit the use of representative refrigerants in equipment testing (as opposed to requiring testing with every refrigerant), equipment models already certified for use with CFCs and HCFCs might not always need additional testing in order to be certified for use with HFCs and PFCs. In addition, as discussed below, EPA is proposing to grandfather existing recovery and recycling equipment that is certified for use with at least two CFCs and HCFCs for use with HFCs and PFCs of similar saturation pressure.

1. Certification of Recovery and Recycling Equipment Intended for Use with Appliances Except Small Appliances, MVACs, and MVAC-like Appliances

a. Background. For recovery equipment used with appliances other than small appliances, MVACs and MVAC-like appliances, the laboratory must verify that the equipment is capable of achieving applicable required evacuation levels and that the equipment releases no more than 3% of the quantity of refrigerant being recycled through noncondensables purging. In addition, the laboratory must measure the vapor and liquid recovery rates of the equipment. To perform all of these measurements, the laboratory must use the test procedure set forth in ARI 740–93, an industry test protocol for recycling and recovery equipment that EPA included in the final rule as Appendix B.

A proposed rule published on February 29, 1996 requested comment on amending the certification requirements to include a new, more representative method for measuring the equipment's refrigerant recovery rate; requirements to measure the equipment's recovery rate and final vacuum at high temperatures; a limit on the total quantity of refrigerant that may be released from equipment from noncondensables purging, oil draining, and equipment clearing; a requirement to measure the quantity of refrigerant left in the condenser of equipment after clearing has occurred; standards for external hose permeability; and a requirement that equipment be tested with recovery cylinders that are representative of those used with the equipment in the field. In addition, EPA proposed to require that equipment that is advertised as ''recycling equipment'' be capable of cleaning up refrigerants to the contamination levels (except that for ''Other Refrigerants'') set forth in the IRG–2 table of Maximum Contaminant Levels of Recycled Refrigerants in Same Owner's Equipment.

b. Certification of Recovery/recycling Equipment Used With HFCs and PFCs. EPA is today proposing equipment certification requirements for recovery and recycling equipment used with HFCs and PFCs that are very similar to the requirements for recovery and recycling equipment used with CFCs and HCFCs, as they were proposed to be amended in the February 29, 1996 document. The evacuation requirements would depend upon the saturation pressure of the refrigerant, the size of the appliance in which it is used, and the date of manufacture of the recovery equipment. These standards, which are described in Table 1 and Table 2, are consistent with the proposed evacuation requirements discussed in section IV.B.1.a. above.

TABLE 1.—LEVELS OF EVACUATION WHICH MUST BE ACHIEVED BY RECOVERY OR RECYCLING EQUIPMENT INTENDED FOR USE WITH APPLIANCES [1] MANUFACTURED ON OR AFTER NOVEMBER 15, 1993

Type of appliance with which recovery or recycling machine is intended to be used.	Inches of vacuum (relative to standard atmospheric pressure of 29.9 inches of Hg)
Very high-pressure appliance	0
Higher-pressure appliance or isolated component of such appliance, normally containing less than 200 pounds of refrigerant	0
Higher-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant	10
High-pressure appliance, or isolated component of such appliance, normally containing less than 200 pounds of refrigerant	10
High-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant	15
Low-pressure appliance	[2] 25

[1] Except for small appliances, MVACs, and MVAC-like appliances.
[2] mm Hg absolute.

The vacuums specified in inches of Hg vacuum must be achieved relative to an atmospheric pressure of 29.9 inches of Hg absolute.

TABLE 2.—LEVELS OF EVACUATION WHICH MUST BE ACHIEVED BY RECOVERY OR RECYCLING EQUIPMENT INTENDED FOR USE WITH APPLIANCES [1] MANUFACTURED BEFORE NOVEMBER 15, 1993

Type of appliance with which recovery or recycling machine is intended to be used.	Inches of vacuum (relative to standard atmospheric pressure of 29.9 inches of Hg)
Very high-pressure appliance	0
Higher-pressure appliance or isolated component of such appliance, normally containing less than 200 pounds of refrigerant	0
Higher-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant	4
High-pressure appliance, or isolated component of such appliance, normally containing less than 200 pounds of refrigerant	4
High-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant	4
Low-pressure appliance	[2] 25

[1] Except for small appliances, MVACs, and MVAC-like appliances.
[2] mm Hg absolute.

The other certification requirements, including the requirement to use the more representative method for measuring the equipment's refrigerant recovery rate, the requirement for high-temperature testing, and limits on refrigerant emissions from air purging, oil draining, equipment clearing, and hoses, would be identical to those proposed for CFC and HCFC recovery and recycling equipment in the February 29, 1996 document.

EPA believes that certification of recovery and recycling equipment used with HFCs and PFCs is necessary to implement and enforce both section 608(c)(2) and section 608(a). In order to comply with the prohibition on venting of substitute refrigerants by making good faith efforts to recover them, technicians must recover the refrigerants using equipment that minimizes refrigerant emissions and mixture, and they must complete the recovery process. Certification of HFC and PFC recovery equipment would permit technicians to achieve all of these goals. First, certification would provide reliable information on the ability of equipment to minimize emissions, measuring and/or establishing standards for recovery efficiency (vacuum level) and emissions from air purging, oil draining, equipment clearing, and hose permeation.

Second, certification would provide reliable information on the equipment's ability to clear itself when it was switched between refrigerants. Without sufficient clearing capability, equipment may retain residual refrigerant in its condenser, which will be mixed with the next batch of a different refrigerant recovered by the equipment. Because it is frequently impossible to reclaim and expensive to destroy, such mixed refrigerant is much more likely than unmixed refrigerant to be vented to the atmosphere. Third, certification would provide reliable information on the equipment's recovery speed, without which technicians may purchase equipment that recovers too slowly, tempting them to interrupt recovery before it is complete. As discussed in the May 14, 1993, final rule, EPA believes that the information on equipment performance provided by a disinterested third-party testing organization is more reliable than that provided by other sources, such as equipment manufacturers (58 FR 28686–28687).

Certification of recovery equipment used with HFCs and PFCs would also maximize recycling and minimize emissions of CFCs and HCFCs. As discussed below, there is no physical difference between ozone-depleting refrigerants and their fluorocarbon substitutes that would prevent a technician from purchasing and using HFC recovery equipment on CFCs or HCFCs. At the same time, uncertified recovery and recycling equipment is likely to be less expensive than certified equipment, which must meet standards and undergo testing. Thus, if uncertified HFC or PFC equipment is available on the market, technicians may well decide to purchase and use it with CFCs and HCFCs instead of or in addition to HFCs and PFCs. In this way, failure to require certification for recovery equipment used with HFCs and PFCs would undermine the current certification program for equipment used with CFCs and HCFCs, leading to greater emissions of the latter. These emissions could occur through any of the routes identified above; that is, directly from leaky or inefficient equipment, or indirectly through refrigerant mixture or incomplete recovery.

c. Use of Representative Refrigerants In Equipment Testing. Currently, equipment certification organizations test recovery and recycling equipment with each of the refrigerants for which the equipment is to be rated. Given the proliferation of new refrigerants and the associated cost of testing equipment with each one, EPA is proposing to permit equipment to be tested with only one or two representative refrigerants from each saturation pressure category for which it is to be rated. At least one of the representative refrigerants would be one that was among the most difficult to recover in its category, that is, a refrigerant whose relatively high saturation pressure and/or discharge temperature made attainment of deep vacuums relatively difficult. This would ensure that equipment that could attain the required vacuums with the representative refrigerant could attain these vacuums with all of the other refrigerants in that category. Other factors that could be considered in the selection of representative refrigerants include moisture affinity, which affects the ease with which refrigerants may be cleaned, materials compatibility, likely popularity, and availability for testing purposes. Different refrigerants might be selected for different testing purposes; for instance, a refrigerant with a high saturation pressure might be selected to test a piece of equipment's ability to draw a vacuum, while a refrigerant with a high moisture affinity might be selected to test the equipment's ability to remove contaminants.

The Agency believes that the saturation pressure (and to some extent, discharge temperature and moisture affinity) of the refrigerant are more important factors in recovery equipment performance than the chemical identity of the refrigerant; in general, equipment that passes the certification test for CFCs and HCFCs is likely to pass the test for HFCs and PFCs of similar (or lower) saturation pressure, as long as the materials used in the recovery equipment are compatible with all of these refrigerants. The equipment certification programs operated by both UL and ARI have been testing recovery and recycling equipment with HFC-134a for the past few years, and equipment performance (final vacuum) with HFC-134a appears to be comparable to that with R-12. EPA requests comment on whether there are factors other than saturation pressure, discharge temperature, moisture affinity, materials compatibility, popularity, and availability that should be considered in selecting a representative refrigerant or in determining the set of refrigerants for which equipment should be certified.

The latest version of ARI 740, ARI 740–1995, already includes a test that is performed with one representative refrigerant. That is high-temperature testing, which is performed with R-22. As discussed in the proposed rule to adopt ARI 740–1995, R-22 was selected because it has a relatively high saturation pressure and discharge temperature, making it harder to recover than many other high-pressure refrigerants (61 FR 7867). Although EPA is proposing to place R22 in a separate saturation pressure category from R134a and R12, EPA believes that it may be appropriate to retain R22 as a representative refrigerant for both pressure categories. EPA requests comment on this issue. EPA also requests comment on whether recovery equipment that is to be certified for use with refrigerants whose saturation pressures are higher than that of R22 should have high-temperature testing performed with R22, or with a higher-pressure refrigerant. Because many new refrigerants have significantly higher saturation pressures than R22 (for instance, R407B has a saturation pressure of 281.7 psia at 104 degrees F, while R22 has a saturation pressure of 222.4 psia at that temperature), EPA believes that equipment that is rated for use with these refrigerants should have high-temperature testing performed with a refrigerant whose saturation pressure is closer to theirs.

In its efforts to revise and update the ARI 740 standard, ARI is currently considering an approach that divides refrigerants into six saturation pressure categories and selects one or two refrigerants for each one. The planned ARI groupings and representative refrigerants for each one are reprinted in Table 3 below.

TABLE 3.—PROPOSED ARI GROUPING OF REFRIGERANTS

Designated group refrigerant	Group No.	Refrigerant No.	PSIA at 104°F, liquid	Bubble point, °F	Critical temp., °F
R-123	I	LOW PRESSURE			
R-11		R-113	18	117.6	417.4
		R-123	22.4	82.1	362.6

TABLE 3.—PROPOSED ARI GROUPING OF REFRIGERANTS—Continued

Designated group refrigerant	Group No.	Refrigerant No.	PSIA at 104°F, liquid	Bubble point, °F	Critical temp., °F
		R-11	25.3	74.9	388.4
R-114	II	MEDIUM PRESSURE—LOW MOISTURE			
		R-114	48.6	38.8	294.3
R-134a	III	MEDIUM PRESSURE			
		R-12	139.7	−21.6	233.2
		R-134a	147.4	−14.9	213.9
		R-401C	151.9	−19.0	234.9
		R-406A	161.4	−26.2	238.1
		R-500	163.7	−28.3	221.9
R-407C	IV	MEDIUM HIGH PRESSURE			
R-22		R-401A	174.9	−27.5	226.4
		R-409A	178.6	−29.6	224.6
		R-401B	183.5	−30.4	223.0
		R-412A	191.8	−37.3	220.6
		R-411A	210.8	−37.5	209.5
		R-407D	217.8	−39.1	216.3
		R-22	222.4	−41.4	205.1
		R-411B	225.5	−42.9	205.7
		R-502	244.8	−49.7	180.0
		R-407C	254.5	−46.4	189.1
		R-402B	255	−53.2	180.7
		R-408A	255	−46.3	182.3
		R-509	256.5	−52.8	188.3
R-410A	V	HIGH PRESSURE			
		R-407A	267.6	−49.9	181.0
		R-404A	269.9	−51.6	161.7
		R-402A	270.6	−46.5	167.9
		R-507	275.5	−52.1	159.6
		R-407B	281.7	−53.1	168.4
		R-410A	352.8	−62.9	162.5
R-508A	VI	VERY HIGH PRESSURE—HIGH MOISTURE			
		R-13	supercritical	−114.5	83.8
		R-23	supercritical	−115.8	78.1
		R-508A	supercritical	−122.2	73.5
		R-503	supercritical	−126.0	67.1
		R-508B	supercritical	−126.9	57.2

ARI's saturation pressure categories are similar, but not identical, to the saturation pressure categories that EPA is proposing to use as the basis for its evacuation requirements. For instance, both EPA and ARI propose to classify R113, R123, and R11 as low-pressure refrigerants, and R13, R23, R508A, R503, and R508B as very-high pressure refrigerants. However, while EPA is proposing to classify R114, R134a, and R401A as high-pressure refrigerants, ARI is proposing to place these refrigerants into three separate saturation pressure categories. Moreover, EPA's proposed dividing line between high and higher-pressure refrigerants would split ARI's ''medium high-pressure'' category in half, falling between R407D and R22.

EPA does not believe that using different saturation pressure categories for selecting representative refrigerants and for determining evacuation requirements would be a problem if the categories for selecting representative refrigerants fell entirely within the categories for determining evacuation requirements. Thus, EPA believes it would be quite reasonable to separate EPA's high-pressure category into three categories for purposes of selecting representative refrigerants; this would simply mean that recovery and recycling equipment would be tested with more refrigerants. However, if a category for selecting representative refrigerants were split into different categories for determining evacuation requirements, confusion and inefficiency could result. For instance, ARI is considering R22 and R407C as representative refrigerants for its ''medium high-pressure'' category. If EPA were to promulgate the categories for evacuation requirements proposed today, recovery/recycling equipment that was being certified for use with any refrigerant in the ''medium high-pressure'' category would have to pull these refrigerants to the relatively deep vacuums required for R12 and R134a, because EPA is proposing to place these refrigerants in the same evacuation category as many of the refrigerants in ARI's ''medium high-pressure category.'' This may be an unnecessarily strict approach, as R22 itself would not need to be drawn to these vacuums in the field. EPA requests comment on this issue.

Because the current regulations establish less stringent evacuation requirements for R22 appliances than for appliances containing refrigerants with lower saturation pressures, and because EPA wishes to retain as much consistency as possible between the proposed and the existing evacuation requirements, EPA is reluctant to eliminate or move its dividing line between the proposed high-pressure and higher pressure evacuation requirement categories. (Again, the proposed dividing line falls between R407D and R22.) In consideration of this issue and the issues discussed above, the Agency requests comment on whether it should adopt the proposed ARI groupings as is or with some changes. If the latter, the Agency requests comment on what changes would be appropriate.

ARI selected the proposed representative refrigerants considering the saturation pressure, discharge temperature, moisture affinity, materials compatibility, and likely popularity of the refrigerants. ARI is considering using both R11 and R123 as representative refrigerants for the low-pressure category because some equipment uses materials that are compatible with R11 but not with R123, and a requirement for performance testing with R123 may reduce the incidence of equipment failure and refrigerant leakage in the field. ARI is considering a separate grouping for R114 because this refrigerant has a saturation pressure that is significantly higher than lower-pressure refrigerants and significantly lower than higher pressure refrigerants. Although R134a is not the refrigerant with the highest saturation pressure in the next, ''medium pressure'' category, ARI is considering it as the representative refrigerant because it is likely to be used widely and the refrigerants with higher saturation pressures (R401C, R406A, R500) are not. R134a also has a relatively high moisture affinity.

ARI is considering using both R22 and R407C as representative refrigerants in the ''medium high-pressure'' category because of their popularity, the high discharge temperature of R22, and the high saturation pressure of R407C at 104 F. (R407C has a saturation pressure of 254.5 psia at that temperature, while the highest pressure refrigerant in the category, R509, has a saturation pressure only 2 psi higher, 256.5) R410A is being considered as the representative refrigerant for the next category because its saturation pressure of 3.8 psia is the highest in its category, and because it has a high moisture affinity. ARI's tentative choice as the representative refrigerant for the very high pressure category is R508A, which is supercritical at 104 degrees F. R508A's critical temperature of 73.5 is 16 degrees higher than that of the highest-pressure refrigerant in the group, R508B, but 10 degrees lower than that of the lowest-pressure refrigerant in the group, R13.

EPA believes that ARI's tentative choices for representative refrigerants would probably appropriately represent their categories, as those categories are currently defined. However, EPA is requesting comment on a few issues. First, EPA requests comment on whether R134a is an appropriate representative refrigerant for the ''medium pressure'' group, given that its saturation pressure is 16 psi lower than the saturation pressure of the highest-pressure refrigerant in the category, R500. Should the likely popularity of R134a relative to R401C, R406A, and R500 overrule its relatively low saturation pressure? Is equipment that successfully recovers R134a in testing likely to fail to recover refrigerant with a saturation pressure 16 psi higher? EPA requests comment on the same issue as it applies to the use of R508A as the representative refrigerant for ''very high pressure'' refrigerants. Finally, EPA requests comment on what refrigerant should be chosen to represent the category of refrigerants whose saturation pressures fall between those of R401A and R407D, in case this category is split off from the current ''medium high pressure'' category, and what refrigerant should be chosen to represent ''high pressure refrigerants,'' in case R410A is split off from this category. EPA believes that R407D and B, which would become the highest pressure refrigerants in these categories, would be appropriate choices, but recognizes that considerations of moisture affinity and/or refrigerant availability may argue for choices with slightly lower saturation pressures.

While the proper selection of representative refrigerants would ensure that recovery equipment could achieve the required vacuum for all the refrigerants in a category, some information would be lost. Specifically, the vapor and liquid recovery rates of equipment with each of the refrigerants in a category would no longer be available. However, technicians and contractors would still be able to compare recovery rates across different makes and models for the representative refrigerant. EPA requests comment on whether the information gained through measuring recovery rates for each refrigerant justifies retaining testing with each refrigerant.

EPA would include representative refrigerants in the equipment testing program by amending Appendix B, the test protocol based on ARI 740–1993. If EPA completes the rulemaking adopting the latest version of ARI 740, ARI 740–1995, before this rule is finalized, EPA would amend that protocol rather than the protocol based on ARI 740–1993. Since the use of representative refrigerants amounts to a relaxation of testing requirements, EPA does not anticipate any problems from adopting this approach only shortly after adopting an earlier set of amendments to the testing requirements.

d. Additional Refrigerants. Industry experts have suggested that a few additional refrigerants could be usefully added to Table 3. These include R124, R125, R403A, R405A, R409B, R410B, and R413B. R124, R125, and R410B are ASHRAE-recognized refrigerants that are included in ARI Standard 700. In addition, R124 and R410B have been determined to be ''acceptable'' for several end-uses under the SNAP program, and R125 is a component of several refrigerant blends that have been determined to be ''acceptable.'' Thus, it appears appropriate to include these in the equipment certification program. Although R403A and R413A have not been submitted for review under SNAP and are not used in the U.S., they are in use overseas. Industry experts believe that certification for these refrigerants could benefit manufacturers who intend to export refrigerant recovery/recycling equipment to Europe and elsewhere. EPA believes that the same logic may apply to R405A, although it has been found to be ''unacceptable'' in the U.S. under SNAP due to its high PFC content. R409B does not yet appear in ARI Standard 700, but R409A, whose composition differs from that of R409B by less than five percent, does. Thus, it also seems reasonable to accommodate this fluid in the equipment certification program. EPA requests comment on these possible additions to the equipment certification program.

REFRIGERANTS RECOMMENDED FOR ADDITION TO TABLE 3

Refrigerant	Group No.	PSIA at 104 °F	Bubble point, °F	Critical point, °F
R-124	II	86.0	10.3	252.4
R-413A	III	167.2	−31.0	198.5
R-405A	IV	177.3	−25.2	223.0
R-409B	IV	186.6	−31.4	221.0
R-403A	IV	244.5	−58.0	199.9
R-125	V	290.9	−54.7	151.3
R-410B	V	350.3	−60.3	159.9

EPA is also requesting comment on how R124 would be integrated into Table 3. The working pressure of R-124 differs sufficiently from R-114 that some equipment may not operate correctly with both fluids. For this reason, industry experts recommend that R124 be listed as an additional refrigerant for group II, subject to the following guidelines:

(a) Equipment that is certified for use in group I may also be certified for group II by testing with R-124. The test for R-114 may be waived as the equipment would be shown to operate correctly for both higher and lower pressure fluids.

(b) Equipment that is certified for use in group III may also be certified for group II by testing with R-114. The test for R-124 may be waived as the equipment would be shown to operate correctly for both higher and lower pressure fluids.

(c) Equipment that is not certified in either group I or group III must be tested using both R-114 and R-124 in order to obtain certification for group II.

(d) Equipment that is not certified in either group I or group III may be certified for a single refrigerant from group II through successful testing with the appropriate refrigerant. EPA requests comment on this approach.

e. Materials Compatibility. Although EPA's preliminary information indicates that recovery and recycling equipment designed for use with CFCs and HCFCs can be used with HFCs and PFCs, some industry experts have raised concerns that lubricants, elastomers, filter driers, and/or motor materials used in recovery and recycling equipment may not be compatible with the full range of halocarbon (CFC, HCFC, HFC, and PFC) refrigerants coming into use. Use of incompatible lubricants may lead to compressor wear and ultimately to compressor failure; use of incompatible filter driers may lead to declining performance in refrigerant blends; use of incompatible elastomers may lead to the failure of seals and subsequently to refrigerant leakage from the equipment; and use of incompatible motor materials may lead to motor failure.

Some industry representatives expressed the concern that many models of recycling and recovery equipment have been built and sold with mineral oil, which is not compatible with HFCs. EPA believes that this concern may be addressed by informing equipment manufacturers and users of the need to replace the mineral oil with ester oil if the equipment is used with HFCs, and possibly by requiring equipment manufacturers to use ester lubricants in equipment certified for use with HFCs. EPA understands that ester lubricants work well with all halocarbon refrigerants, and that changing out the oil in recycling and recovery equipment is usually a simple and routine procedure. HCFCs, which dissolve easily into ester oil, may thin it out, necessitating the use of higher viscosity oils, but recycling and recovery equipment manufacturers may address this problem simply by using (or specifying use of) a higher viscosity lubricant. EPA requests comment on whether sufficient mechanisms exist within the industry to ensure that the need and method for changing out lubricants is transmitted to manufacturers and users of recycling and recovery equipment, and whether EPA should require that equipment certified for use with HFCs be sold with ester lubricants.

In addition, industry sources expressed the concern that filter driers, particularly those containing activated carbon, may react undesirably to certain refrigerant blends. Undesirable reactions might include the selective uptake of refrigerant components, changing the composition of the blend, or extreme heating when a filter drier containing activated carbon is used with blends containing hydrocarbon refrigerants. EPA understands that some types of filter driers absorb some blend components more than others, but that this absorption is usually not sufficiently pronounced to significantly change the performance of the blend. EPA further understands that some heating is inevitable when activated carbon is used, but that this heating may not be very great, and that it is counteracted by the refrigerant's tendency to carry heat away from the drier. EPA requests comment on these issues. If some types of filter driers are incompatible with some types of blends, EPA requests comment on whether the Agency should require the use of other types of filter driers that are compatible with all refrigerants, or whether the Agency should require equipment manufacturers to demonstrate, through testing, that the filter driers used in their equipment are compatible with all of the refrigerants for which the equipment is to be certified.

Industry experts also expressed the concern that compressor and motor materials may not be compatible with new refrigerant and lubricant combinations. EPA understands that most recycling and recovery compressors and motors that are intended for use with high-pressure refrigerants are designed to work with R502 and mineral oil. Because the combination of R22 (a component of R502) and mineral oil is a relatively aggressive one (i.e., is likely to chemically attack compressor components), EPA believes that compressors and motors that are designed to handle this combination are likely to tolerate other refrigerant/lubricant combinations, such as HFCs and ester oils. However, EPA requests comment on this issue. EPA also requests comment on whether compressors and motors that are designed to handle refrigerant/lubricant combinations other than R502 and mineral oil (e.g., R11 and mineral oil) may pose compatibility concerns.

Finally, some industry sources stated that the elastomers used in O-rings and other types of seals may not be compatible with all types of refrigerants and lubricants. Some of the potential effects of incompatibility include the swelling of O-rings, which would make it difficult to make and break connections without leakage, and the high-temperature hardening or ''compression set'' of shaft seals on open-drive compressors, which would lead to failure of the seal. EPA understands that no single material is likely to work equally well with all combinations of refrigerants and lubricants, and that similar materials (e.g., two types of neoprene) may not be equally compatible with the same refrigerant/lubricant combinations. Thus, rather than specifying the use of any single material or set of materials, the Agency is considering requiring manufacturers of recovery and recycling equipment to use materials that have been shown to be compatible with the refrigerants for which the equipment is to be rated or certified. The method for demonstrating compatibility might be sealed tube testing under the conditions of *ASHRAE 97* or some other standard; manufacturers could use the results of industry-wide testing (e.g., MCLR/ARTI testing) if such testing had been performed for the materials, refrigerants, and lubricants of concern. Another possible means of addressing compatibility concerns would be to require manufacturers to test recovery and recycling equipment with all the major refrigerant groups (CFCs, HCFCs, and HFCs and their associated lubricants); but the duration of equipment testing may not be sufficient to reveal compatibility problems, raising the question of whether the additional testing would be useful or justified. EPA requests comment on the elastomer compatibility issue and on the above approaches for addressing it.

f. Fractionation. For a number of reasons, some industry experts have expressed concern that recycling and recovery equipment, and to some extent, the process of recovery itself, may change the composition of refrigerant blends, affecting their performance. Ways in which recycling and recovery equipment might conceivably change the composition of blends include the selective absorption of certain components by filter driers (discussed above), selective removal of components with higher solubility in oil through oil separation, selective release of certain components during noncondensables purging, and possibly selective diffusion of certain components (those with lower molecular weights) through hoses.

EPA is aware of two studies that have been performed to ascertain how recovery and recycling may affect the composition of blends [24]. One study, performed by ICI Klea, modeled blend behavior during recovery and recycling based on the thermophysical properties of the refrigerants. The other study, performed by Robinair, examined how blend composition changed during and after repeated recycling using actual recycling equipment. Both studies showed recycling had little impact on blend composition, if the complete charge was removed from the system and recharged back into it at the conclusion of service. However, because different models of recovery and recycling equipment may have different impacts on blend composition, and because few models were actually tested in the studies, EPA is requesting comment on whether the certification program for recycling and recovery equipment should be expanded to test equipment's tendency to change blend composition.

g. Flammability. Some refrigerants that have entered the market over the past few years, such as R406A, may be flammable under some conditions (e.g., after fractionation). EPA requests comment on whether the equipment certification program should test whether equipment that is to be certified for ''flammable'' refrigerants may be used with them safely, and if so, how ''flammable'' refrigerants should be defined for purposes of equipment testing. ARI is currently considering certifying equipment for use with refrigerants classified under ASHRAE Standard 34 as ''lower flammability'' (Class 2); no ''higher flammability'' (Class 3) refrigerants are included in Table 3. EPA requests comment on whether the recovery and recycling process could lead to refrigerant ignition for the Class 2 refrigerants in Table 3. Could these refrigerants (or a subset of them) be ignited by high motor temperatures or by sparking of switches or other equipment components during recovery and recycling? If so, what kinds of tests would be appropriate to determine whether a model of recovery and recycling equipment could be used with these refrigerants safely? Should the ASHRAE 34 classification system be used for purposes of determining flammability for recovery and recycling equipment certification, or would some other system (e.g., one based on auto-ignition temperature) be more appropriate?

If equipment's ability to safely process flammable refrigerants should be tested, EPA requests comment on how representative ''flammable'' refrigerants might be chosen. One possible approach would be to establish a separate category for ''flammable'' refrigerants in Table 3, and to test the most flammable among them (using whatever criterion for flammability is ultimately chosen) with the recovery and recycling equipment.

2. Certification of Recovery and Recycling Equipment Intended for Use With Small Appliances

Recovery equipment intended for use with small appliances containing CFCs or HCFCs must currently be tested by an EPA-approved testing organization to verify that it meets at least one of two sets of standards. The equipment must either (1) recover 90% of the refrigerant in the small appliance when the compressor is operating and 80% of the refrigerant in the small appliance when the compressor is not operating, when tested according to Appendix C, or (2) be able to pull a four-inch vacuum when tested according to Appendix B. Equipment manufactured before November 15, 1993, is grandfathered if it can recover at least 80% of the refrigerant in the small appliance whether or not the compressor is operating. EPA is proposing to extend these requirements to recovery equipment that is intended for use with small appliances containing HFCs or PFCs.

Appendix C currently requires that recovery equipment be tested using CFC-12. EPA requests comment on whether appendix C should be amended to require testing with substitute refrigerants in addition to or in place of CFC-12. The substitute refrigerant(s) chosen would be one used in small appliances. As discussed above, EPA is proposing to amend Appendix B to permit testing of equipment with a single representative refrigerant from each saturation pressure and moisture affinity category, and a similar approach may be appropriate for Appendix C.

One factor in addition to saturation pressure that has an impact on recovery efficiencies from small appliances is the miscibility of the refrigerant in the system lubricant. This is especially important in small appliances because there is often as much lubricant in a small appliance as there is refrigerant, and a large percentage of the refrigerant may therefore remain entrained in the lubricant even if the system pressure is relatively low. EPA requests comment on whether its certification requirements for recovery equipment used with small appliances should be amended to account for differences in the miscibilities of CFC-12 and the HFCs in their associated lubricants.

3. Approval of Equipment Testing Organizations To Test Recovery Equipment With HFC and PFC Refrigerants

EPA has approved two equipment testing organizations, the Air Conditioning and Refrigeration Institute and Underwriters Laboratories, to certify equipment under the current standards at § 82.158(b) and Appendix B. EPA anticipates that both organizations will apply to certify equipment under the standards based on ARI 740–95 when these are promulgated in the near future. EPA is proposing to require that approved equipment testing organizations would also have to apply to EPA to become approved to certify equipment under the standards described above, once these are promulgated. However, these organizations would not need to resubmit the information on their test facilities, equipment testing expertise, long-term performance verification programs, knowledge of the standards, and objectivity that they submitted to become approved to certify under § 82.158(b) and Appendix B, or under the new standards based on ARI 740–95. Instead, they would have to submit information only in those areas where their certification programs under the standards described above differed from their previously approved programs. Because the standards described above do not require any testing equipment that differs from that required for the standards based on ARI 740–95, EPA expects submissions to focus on the organizations' knowledge of how the new standards differ from the old. EPA

[24] Kenneth W. Manz, Robinair Division, SPX Corporation, ''Recycling Alternate Refrigerants R-404a, R–410a, and R507,'' and R.W. Yost, ICI Klea, ''Practical Aspects of Zeotrope Fractionation in Recovery and Recycling,'' both presented at the 1996 ASHRAE Winter Meeting, Atlanta, Georgia, February 19, 1996. Copies of the presentations are available for inspection in the public docket for this rulemaking. A yet-to-be-published study performed by EPA's Office of Research and Development yielded similar results.

believes that a one- to two-page letter would suffice.

4. Use of Existing CFC/HCFC Recovery Equipment With HFC and PFC Refrigerants

EPA is proposing to permit technicians to use equipment that is certified for use with at least two CFCs and HCFCs to recover HFCs and PFCs of similar saturation pressure. Based on discussions with equipment manufacturers and testing organizations, EPA believes that most recovery and recycling equipment designed for use with multiple CFC or HCFC refrigerants (e.g., R12, R22, R500, and R502) can be adapted for use with HFC and PFC refrigerants with similar saturation pressures, usually by changing the lubricant to POE lubricant. This equipment would have to meet the standards presented in Table 1 and Table 2. In addition, if it was manufactured on or after November 15, 1993, it would have to have been certified by an EPA-approved third-party certification program (ARI or UL) for at least two refrigerants with saturation pressures similar to the saturation pressure of the refrigerant(s) with which the equipment is to be used. EPA requests comment on this proposal. EPA specifically requests comment on whether and how the Agency should integrate into its grandfathering policy the considerations enumerated above in the discussion of certification of new equipment, including materials compatibility, flammability, and blend fractionation. EPA also requests comment on whether it should permit equipment that was originally designed for use with a single refrigerant to be used with multiple refrigerants. EPA is concerned that equipment designed for use with a single refrigerant may not be equipped with a clearing mechanism to prevent cross-contamination when it is used with a different refrigerant.

D. Technician Certification

Any person doing work that ''could reasonably be expected'' to release refrigerant from CFC and HCFC appliances is required to become certified. In addition, sales of CFCs and HCFCs are restricted to certified technicians. Technicians become certified by passing a test drawn from a question bank developed jointly by EPA and industry educational organizations. The test includes questions on the role of CFCs and HCFCs in ozone depletion, the requirements of the refrigerant recycling rule, and proper techniques for recycling and conserving refrigerant. EPA makes the question bank available to certifying organizations that demonstrate that they can properly generate, track, and grade tests, issue certificates, and keep records.

EPA is proposing to extend the certification requirements for technicians who work with CFC and HCFC refrigerants to technicians who work with HFCs and PFCs. Technicians who have been certified to work with CFCs and HCFCs would not have to be retested to work with HFCs or PFCs, but new technicians entering the field would have to pass the test to work with CFCs, HCFCs, HFCs, and/or PFCs.

EPA believes that requiring certification of technicians who work with HFCs and PFCs is necessary to implement and enforce both section 608(c) and section 608(a)(2) effectively. As discussed above, section 608(c) prohibits the knowing release of substitute refrigerants during the service, maintenance, repair or disposal of appliances, except for de minimis releases associated with ''good faith attempts to recapture and recycle or safely dispose'' of the refrigerants. It is reasonable to interpret ''good faith attempts to recapture and recycle or safely dispose'' as requiring that service, maintenance, repair, or disposal that could release substitute refrigerant be performed by a certified technician. This interpretation is also consistent with EPA's interpretation of the same statutory language as it applies to ozone-depleting refrigerants. For the reasons discussed below, persons who are not certified technicians are far more likely to intentionally or inadvertently release refrigerant contrary to the venting prohibition. In addition, consistent application of technician certification requirements and a sales restriction to class I and II refrigerants and their substitutes is necessary to implement the section 608(a) directive to reduce releases and maximize recapture and recycling of class I and II refrigerants. Technician certification requirements for work with substitute refrigerants would directly reduce some releases of class I and II refrigerants. It would also protect against refrigerant mixture, which otherwise is likely to cause more substantial releases of class I and II refrigerants.

EPA believes that having a certified technician perform the work on an appliance is an important component of good faith recapture and recycling. Certified technicians are much more likely to understand how and why to recover and recycle refrigerants and to have the means to do so. First, technician certification ensures that technicians are trained in refrigerant recovery requirements and techniques. Until recently, technicians in many sectors were not recycling refrigerants at all, and technicians who did recycle were not necessarily minimizing emissions as much as possible. Thus, many technicians lacked expertise that they would need to comply with the recycling and recovery provisions and hence needed training to acquire that expertise. However, while some vocational schools and training programs addressed refrigerant recovery, participation in such programs was low. Given this situation, EPA was concerned that without a testing or training requirement, recovery and recycling often would not occur at all or would occur improperly, leading not only to refrigerant release, but to refrigerant contamination, safety concerns, productivity losses, and equipment damage. EPA discussed at length the benefits of training and certification in the final rule published on May 14, 1993 (58 FR 28691–28694) and in the Regulatory Impact Analysis performed for that rule (6–34 through 6–39). The importance of a certification requirement was confirmed when participation in training programs rose in response to reports that certification would be required, and then fell sharply in response to reports that it would not be required. This indicated that service practice requirements were not, by themselves, likely to drive technicians to acquire training in how to comply with such requirements.

Second, in addition to possessing training in refrigerant recovery, certified individuals are more likely than uncertified individuals to have access to recovery equipment. This is because uncertified individuals, particularly those who work only on their own appliances (e.g., on their own car air conditioners), are unlikely to find it cost-effective to purchase their own recovery equipment. Thus, they are able neither to recover the refrigerant from the appliance before it is serviced nor to recover the ''heel'' of residual refrigerant from the refrigerant container before it is disposed of. Both the refrigerant in the appliance and that in the refrigerant container are therefore released. (The ''heel'' is ultimately released to the atmosphere when the container is crushed or corroded.)

EPA anticipates that for the next decade, the majority of technicians subject to section 608 requirements will continue to work with and purchase CFCs and HCFCs and will therefore be certified under the current program.[25]

[25] EPA does not anticipate that many homeowners or other consumers would elect to perform their own repairs on household refrigerators and air conditioners. However, based

However, EPA is concerned that a significant minority could emerge that would work primarily with HFCs, particularly if a lack of certification requirements for work with substitutes created an incentive for doing so. In this case, large numbers of technicians who worked with HFCs might not receive proper training in refrigerant recycling or recovery, leading to release of HFCs. For example, an uncertified person could vent refrigerant before repairing an appliance containing an HFC refrigerant, thereby violating the venting prohibition. Thus, requiring certification for technicians who work with substitute refrigerants is necessary to implement the section 608(c) prohibition.

Requiring certification for technicians who work with substitute refrigerants is also necessary to comply with the section 608(a) requirements for EPA to promulgate regulations that reduce emissions of class I and II refrigerants to the lowest achievable levels and maximize recapture and recycling of such substances. Failure to require technician certification is likely to lead to increased emissions and reduced recycling of ozone-depleting substances under several scenarios. As discussed above, the lack of a technician certification requirement would encourage the emergence of a class of uncertified technicians working primarily with HFCs. However, once such persons were working as professional refrigeration and cooling technicians, there would be strong economic incentives for them to overlook the restrictions on their ability to work with ozone-depleting refrigerants as well. In fact, because of the absence of a certification requirement and their consequent lack of adequate training, they might be unaware of the existence or scope of the restrictions. Thus, they might fail to recycle class I and class II refrigerants properly, and might not recycle them at all. Uncertified technicians would also be likely to perform retrofits using HFCs, which they would be legally entitled to purchase. However, the appliance that they would be retrofitting would contain ozone-depleting substances. Such uncertified technicians would be likely to vent the ozone-depleting substance prior to retrofitting, given their probable lack of training and the fact that return of the substance to a reclaimer would reveal that they were handling it illegally.

Failure to require technician certification to work with HFCs is also likely to encourage the inappropriate mixture of HFC and ozone-depleting refrigerants. In this scenario, refrigerant mixture could occur because uncertified technicians might wish to service CFC or HCFC equipment, but would have access only to HFCs because sales of CFCs and HCFCs are limited to certified technicians. Lacking training, these technicians would probably have a poor understanding of the consequences of mixing refrigerants, and would therefore be more likely than certified technicians to add HFCs to CFC or HCFC systems.

The consequences of such inappropriate mixture include significant losses in performance and energy efficiency in equipment serviced with mixed refrigerants, damage to equipment, the lost value of the mixed refrigerant (which is at best difficult, and often impossible, to separate), and costs for destroying mixed refrigerants. Refrigerant mixture also leads both directly and indirectly to refrigerant release. Mixture leads directly to release because mixtures of certain refrigerants, such as R12 and R134a, have higher pressures than either component alone. Thus, pressure-sensitive components such as air purge devices on recycling machines and relief devices on appliances may be activated by these mixtures, venting the refrigerant to the atmosphere. Purge devices in particular are often set to open when the pressure of the recovery cylinder's contents rises more than 5–10 psi above the expected saturation pressure for the refrigerant; this margin is exceeded by R12/R134a mixtures containing more than ten percent of the contaminating refrigerant.[26] Refrigerant mixture also reduces recycling and leads indirectly to release. First, mixed refrigerants not only lose their value but cost money to reclaim or destroy, encouraging venting. Second, the direct releases and equipment breakdowns caused by contamination lead to increased equipment servicing, which itself leads to unavoidable releases of refrigerant. Thus, whether the refrigerant were vented or mixed, failure to impose a certification requirement on persons working with HFCs would increase the probability of both HFCs and ozone-depleting refrigerants being emitted to the atmosphere.

Evidence collected by EPA indicates that without certification requirements for technicians who work with substitute refrigerants, the emergence of a class of uncertified individuals who are liable to mix refrigerants is likely. Advertisements for one alternative have highlighted the fact that technicians need not be certified to purchase it. These advertisements have also implied, incorrectly, that the substitute may be mixed with R12 without consequence. These advertisements indicate that there is a market for alternatives that can be purchased without certification and that can be used to service CFC and HCFC equipment. At the same time, the advertisements indicate that some parts of the market are transmitting incorrect information that is likely to lead to the inappropriate mixture of the alternatives with CFCs and HCFCs. EPA believes that technicians who have not received training in the need to avoid mixing refrigerants are far more likely to fall prey to such false advertising than certified technicians, who have received training.

Experience from the sales restriction on small containers, which was mandated under section 609 of the Act before the sales restriction under 608 became effective, also strongly supports EPA's concern that inconsistent imposition of technician certification requirements or sales restrictions will lead to refrigerant mixture. Some industry representatives have reported that when sales of small containers of R12 were restricted to only certified technicians, containers of R22, which could still be sold to the general public, began appearing in stores catering to the automotive DIY consumer. This implies that R22 was being used to service R12 equipment. Statistics collected by the Mobile Air Conditioning Society (MACs) indicate that approximately three percent of motor vehicle air conditioners now being serviced are contaminated by mixed refrigerants.

In addition to concerns related to refrigerant mixture and release, industry representatives at the March 10, 1995 meeting cited the need for fairness and consistency in applying rule provisions to all potentially environmentally damaging refrigerants. The two contractors present voiced the opinion that the imposition of less stringent recovery or certification requirements for HFCs could undermine compliance with recycling requirements for both HFCs and ozone-depleting refrigerants by confusing technicians and encouraging a ''cavalier'' attitude toward refrigerant recovery. Other industry representatives noted that due to similar concerns, their organizations

on the past ''Do-It-Yourself'' (DIY) market for MVAC refrigerant, EPA expects that many car owners would elect to perform their own repairs on MVACs, if they could obtain refrigerant to do so. Thus, as discussed below, any sales restriction on HFCs would affect both uncertified 608 technicians and the MVACs DIY population.

[26] Based on pressure-temperature graphs provided to Debbie Ottinger of the Stratospheric Protection Division, EPA, by Dave Bateman of the DuPont Company, April 29, 1996.

already required certification for technicians working with HFCs.

For these reasons, EPA currently believes that it is necessary to impose a technician certification requirement in order to implement sections 608(a) and 608(c), and that EPA has authority under these sections to promulgate a technician certification requirement. EPA requests comment on the likelihood that failure to impose a technician certification requirement on persons working with HFCs and PFCs would lead to release and mixture of both ozone-depleting refrigerants and substitutes.

As noted above, EPA is not proposing to require that technicians who have been certified to work with CFCs and HCFCs undertake additional training and testing to work with HFCs and PFCs. The techniques and requirements for recycling HFCs and PFCs are very similar to those for CFCs and HCFCs; where there are differences (such as compatibility with different lubricants), these differences have been highlighted by the certification program for CFCs and HCFCs. In addition, based on statements made by industry and educational representatives at the March 10, 1995 industry meeting, EPA believes that more recent information on proper handling of HFCs and PFCs will be disseminated to certified technicians through refrigerant and equipment manufacturers, industry associations, and the trade press. Thus, the benefits of any recertification requirement would probably be small, and would likely be outweighed by the costs of such recertification. Instead, as part of its regular update of the technician certification question bank, EPA is planning to include more questions on handling HFC and PFC refrigerants and on the potential impacts of global warming. EPA requests comment on this approach for already certified technicians.

E. Sales Restriction

Under the current regulations promulgated under sections 608 and 609, only certified technicians may purchase CFC and HCFC refrigerants. EPA is proposing to extend this sales restriction to HFC and PFC refrigerants. The sales restriction would apply to HFC and PFC refrigerants sold in all sizes of containers for use in all types of appliances, including motor vehicle air conditioners. EPA considers the sales restriction to be necessary to enforce the technician certification requirements of both the refrigerant recycling regulations promulgated under section 608 and those promulgated under section 609 [27] and ultimately, to implement the requirements of sections 608(a) and 608(c)(2).

In the absence of a sales restriction, the size and mobility of the population that is subject to the technician certification requirements would make compliance monitoring extremely difficult. Approximately 1.4 million technicians are employed in the stationary and mobile air-conditioning and refrigeration sectors. Many of these technicians, particularly those in the stationary sector, may work out of vans rather than having any fixed place of business. The sales restriction ensures that these technicians are certified by placing monitors on their supply lines. Because inspections can be performed at a relatively small number of centralized retailer and wholesaler locations, the sales restriction itself is relatively easy to enforce.

Discussions with industry representatives indicate that the sales restriction on CFCs and HCFCs was important in encouraging large numbers of technicians to obtain certification. The largest certification organizations report that the numbers of people interested in obtaining certification rose sharply as the November, 1994 effective date of the sales restriction approached. Moreover, the contractors who staff EPA's Stratospheric Ozone Hotline state that during the summer, they receive between 20 and 40 telephone calls per day from individuals who indicate that they are seeking technician certification specifically because they want to be able to purchase refrigerant. This is strong evidence that the sales restriction is critical for ensuring that technicians are certified. As discussed above, EPA believes that technician certification is necessary to meet the requirements of sections 608(a) and (c).

While there are methods of discouraging refrigerant mixing and release other than technician certification combined with a sales restriction, none of them appear to be sufficiently effective to substitute for a sales restriction. One alternative method for preventing mixture of ozone-depleting and HFC refrigerants might be to require that both HFC containers and HFC appliances be equipped with unique fittings that would prevent them from being connected to CFC or HCFC containers and appliances. Under the SNAP program, HFC-134a containers sold for use in the automotive market and MVACs that use HFC-134a are required to be equipped with such fittings.

However, while such fittings may be effective in reducing mixture in some sectors, EPA believes that they would be impractical in other sectors and would not necessarily reduce the venting of the CFC or HCFC to be replaced. Only motor vehicle air conditioners (MVACs) containing substitutes currently possess the specialized fittings; other types of air-conditioning and refrigeration equipment containing substitutes, including household, commercial, and industrial refrigerators and air-conditioners, do not. Introducing a unique fittings requirement to these stationary sectors would be impractical for several reasons.

The most fundamental reason is that the wide array of substitute refrigerants available for stationary equipment makes the development of a unique fitting for each one almost impossible. At least 25 refrigerants are currently being used in the stationary air-conditioning and refrigeration sectors, and more are being developed. Unique fittings are designed by choosing the diameter, turning direction, thread pitch (threads/inch) and shape of threads (normal vs. square, also known as Acme). However, fittings with the same diameter and turning direction can nearly always be connected using a wrench, regardless of thread pitch or shape. Therefore, practically speaking, the number of different fittings is limited to the double the number of different diameters. (Each diameter yields both a clockwise and a counterclockwise fitting.) The number of diameters is itself limited because fittings must differ by at least 0.063 inch in diameter to ensure they will not cross-connect, and the range of diameters is limited by valve core and surrounding space restrictions. (In the MVAC market to date, valve core and surrounding space restrictions have resulted in fittings ranging in diameter from 0.3 inches to 0.625 inches.) Thus, the number of unique fittings that can be developed is limited.

Moreover, even if unique fittings could be found for each of the refrigerants used in the stationary sectors, the logistics of implementing them would be formidable. To begin with, a massive program would be required to retrofit existing stationary appliances and recovery equipment with all of the unique fittings. A great deal of equipment in the stationary

[27] EPA published a final rule under section 609 on December 30, 1997 that requires technicians servicing MVACs containing substitute refrigerants to become certified. However, while section 609 restricts the sale of small containers of class I or class II refrigerants, it does not restrict the sale of HFC or PFC refrigerants. Thus, any sales restriction on these refrigerants must be promulgated under the authority of section 608.

sector has already been retrofitted to use substitute refrigerants; retrofits would presumably be required not only for all this equipment, but for all of the equipment that uses one of the four traditional high-pressure refrigerants (R12, R22, R502, and R500). Otherwise, technicians who became accustomed to relying on fittings to distinguish among refrigerants might cross-contaminate these four.

In addition, the large number of fittings in the stationary sectors would make their use as a control on contamination unwieldy. A single piece of recovery equipment intended for use with high-pressure refrigerants might conceivably require over 20 fittings. Given the similar exterior appearances of the fittings, finding the one that matched a particular appliance would be difficult.

More important, this matching of fittings with appliances is not necessary if the recovery equipment has been properly cleared before use with a new refrigerant. Technicians who work on stationary air-conditioning and refrigeration equipment have long worked with multiple refrigerants, and recovery equipment for stationary appliances has been designed for use with multiple refrigerants. Instead of engineering controls, the stationary sectors have relied on training in refrigerant charging and recovery to prevent cross-contamination. Adopting unique fittings in these sectors would represent a fundamental change of approach that would not only be unwieldy but redundant.

Leaving aside the difficulty of introducing unique fittings to the sectors that do not have them, these fittings may not be sufficient to prevent cross-contamination in those sectors that do have them, such as the automotive sector. Containers of HFCs that are intended for the stationary sector and that therefore possess generic fittings may find their way into the automotive air conditioning sector; industry representatives have stated that this is already occurring to some extent. In addition, equipment is available (e.g., old manifolds with multiple hoses, side can tappers) that permits technicians or DIYers to defeat the specialized fittings when the container is equipped with them. Again, industry representatives indicate that this type of cross contamination is already happening, and the statistics on contaminated refrigerant from the automotive industry support them.

Finally, there is no reason to believe that specialized fittings would prevent an uncertified person from venting the original CFC or HCFC before attempting to recharge a system with a substitute, because this venting may well take place before the person discovers that he or she cannot recharge the equipment with the purchased substitute. As noted above, such venting prevents the requirements of 608(c) and 608(a) from being met.

One option that would address the first of these three concerns, but not the last two, is a more limited sales restriction. This would restrict to certified technicians the sale of containers of substitute refrigerants that lack specialized fittings, but would permit the sale of containers of substitute refrigerants that contain such fittings to the general public. In this manner, DIY consumers and uncertified technicians would have unlimited access only to containers with fittings, making mixture more difficult. However, EPA is concerned that this approach would still permit mixture through defeat of the fittings and would fail to address venting of the refrigerant previously in the system. EPA requests comment on the potential effectiveness and enforceability of such a restriction.

F. Safe Disposal of Small Appliances, MVACs, and MVAC-like Appliances

1. Coverage of HFCs and PFCs

EPA is proposing to adopt the same approach to the disposal of small appliances, MVACs and MVAC-like appliances charged with HFCs and PFCs that it has adopted for these types of equipment charged with CFCs and HCFCs. In the May 14, 1993 rule, EPA established specific requirements for the safe disposal of appliances that enter the waste stream with the charge intact, including small appliances, MVACs, and MVAC-like appliances. Persons who take the final step in the disposal process of small appliances, MVACs, and MVAC-like appliances that contain CFCs or HCFCs must either recover any remaining refrigerant in the appliance or verify that the refrigerant has previously been recovered from the appliance or shipment of appliances. If they verify that the refrigerant has been recovered previously, they must retain a signed statement attesting to this. Recovery equipment used to remove the refrigerant must meet certain standards but does not need to be certified by a third party. Similarly, persons recovering the refrigerant need not be certified.

In addition to the specific safe disposal requirements, refrigerant recovered from disposed small appliances, MVACs, and MVAC-like appliances is subject to the reclamation requirements at § 82.156(g) and (h), which safeguard the purity of refrigerant flowing into the stationary equipment service sectors, and to the reclamation requirement in Appendix A to subpart B, which safeguards the purity of refrigerant flowing into the MVAC and MVAC-like appliance service sectors.

In recent amendments to the subpart B MVAC recycling regulation, EPA explicitly permitted refrigerant recovered from MVACs and MVAC-like appliances at disposal facilities to be reused in MVACs and MVAC-like appliances without being reclaimed as long as certain other requirements were met. These requirements, which apply to HFCs (in MVACs) in addition to CFCs and HCFCs, include the following: Only 609-certified technicians or disposal facility owners or operators may recover the refrigerant; the refrigerant recovered from the MVACs and MVAC-like appliances may not be mixed with refrigerant from any other sources; only section 609-certified recovery equipment may be used to recover the refrigerant; the refrigerant may be reused only in an MVAC or MVAC-like appliance; the refrigerant may be sold only to section 609-certified technicians; and section 609-certified technicians must recycle the refrigerant in section 609-certified recycling equipment before charging it into the MVAC or MVAC-like appliance. As discussed in the amendments to the 609 rule, these restrictions are intended to ensure that the exemption from the reclamation requirement for refrigerant removed from and charged into MVACs and MVAC-like appliances does not compromise the purity of refrigerant flowing into the MVAC and MVAC-like appliance service sectors.

Most of the restrictions (except for the sales restriction and the restrictions as they would apply to MVAC-like appliances) are authorized by section 609, which requires persons servicing motor vehicles for consideration to properly use approved refrigerant recycling equipment and to be properly trained and certified. The statutory definitions of ''properly use,'' ''approved equipment'' and ''properly trained and certified'' all reference SAE standards that include purity requirements for refrigerant used to service MVACs.

These requirements for reuse of refrigerant from MVACs and MVAC-like appliances at disposal facilities apply *in addition* to the basic safe disposal requirements of the subpart F regulations under section 608, particularly the requirement that disposers recover the refrigerant (or ensure that the refrigerant is recovered by others) from the MVAC or MVAC-like appliance before the final step in the disposal process. Disposal facilities must also continue to observe the requirement that they retain signed statements attesting to the removal of the refrigerant from the MVAC or MVAC-like appliance, if applicable.

When refrigerant is recovered from disposed small appliances or when it is recovered from disposed MVACs or MVAC-like appliances and not reused in MVACs and MVAC-like appliances, only the safe disposal and reclamation requirements set forth in the subpart F regulations apply. In today's notice, EPA is proposing to extend these requirements to small appliances, MVACs, and MVAC-like appliances that contain HFCs. These requirements are necessary to implement the 608(c)(2) prohibition on release of substitute refrigerants by defining good faith attempts to recapture and recycle or safely dispose of the refrigerant in the context of the disposal of small appliances, MVACs, and MVAC-like appliances. EPA believes that the rationale for establishing the safe disposal requirements for small appliances, MVACs, and MVAC-like appliances that contain CFCs and HCFCs also applies to these appliances when they contain substitutes for CFCs and HCFCs. As discussed at length in the May 14, 1993 rule, these requirements are designed to ensure that refrigerant is recovered before the appliance is finally disposed of while granting as much flexibility as possible to the disposal facility regarding the manner of its recovery (58 FR 28702). EPA considered such flexibility important for the disposal sector, which is highly diverse and decentralized. Because the disposal infrastructure for appliances charged with HFCs and PFCs is identical to that for appliances charged with CFCs and HCFCs, EPA believes that these considerations apply equally to appliances containing HFCs and PFCs. In addition, applying a consistent set of disposal requirements to appliances containing CFCs, HCFCs, HFCs, and PFCs will reduce confusion and minimize emissions of all four types of refrigerant during the disposal process. Thus, the Agency believes that the regulations regarding the safe disposal of appliances charged with HFCs should be the same as those regarding the safe disposal of appliances charged with CFCs and HCFCs. EPA requests comment on this proposal.

2. Possible Clarifications

EPA is also requesting comment on two possible modifications that EPA is considering making to the safe disposal provisions to ensure that EPA's interpretation of the regulation is clear on its face. As stated in Applicability Determination number 59, the Agency interprets the safe disposal provisions to apply to ''the entity which conducted the process where the refrigerant was released if not properly recovered.''

Together, the possible changes to the regulations would clarify that paragraph 82.156(f) applies to persons who perform disposal-related activities where the refrigerant would be released if not properly recovered. One clarification would amend the definition of ''opening'' to include the disposal of appliances. The first sentence of the revised definition of ''opening'' would read, ''Opening an appliance means any service, maintenance, repair, or disposal of an appliance that would release refrigerant from the appliance to the atmosphere unless the refrigerant were recovered previously from the appliance.'' The rest of the definition would remain unchanged.

The second clarification would add the phrase ''persons who open the appliances in the course of disposing of them'' to the introductory text of § 82.156(f). The revised text would read (in part), ''persons who take the final step in the disposal process of small appliances, MVACs, or MVAC-like appliances (including but not limited to scrap recyclers, landfill operators, and persons who open the appliances in the course of disposing of them) must either: (1) Recover any remaining refrigerant from the appliance in accordance with paragraph (g) or (h) of this section, as applicable; or (2) Verify that the refrigerant has been evacuated from the appliance or shipment of appliances previously.'' The rest of § 82.156(f) would remain unchanged. EPA requests comment on these two possible changes.

G. Certification by Owners of Recycling or Recovery Equipment

EPA currently requires persons who maintain, service, repair, or dispose of appliances containing CFCs or HCFCs to submit a signed statement to the appropriate EPA Regional office stating that they possess recovery and recycling equipment and are complying with the applicable requirements of the rule. EPA is proposing to extend this provision to persons who maintain, service, repair, or dispose of appliances containing HFCs or PFCs. Persons who had already sent a signed statement to EPA for their work on appliances containing CFCs or HCFCs would not need to send a new statement. EPA anticipates, therefore, that only businesses coming into existence after the date of publication of the final rule would potentially be affected by the amended provision.

EPA believes that the rationale for requiring this report from persons who maintain, service, repair, or dispose of appliances containing HFCs or PFCs is the same as that for requiring it from persons who maintain, service, repair, or dispose of appliances containing CFCs or HCFCs. That is, the requirement would help ensure that persons who opened or disposed of appliances were making a good faith effort to recover and recycle the refrigerant and had the appropriate equipment available to comply with the section 608(c) venting prohibition. EPA would also use this information in conjunction with telephone or other business listings to target its efforts to enforce the venting prohibition. Finally, consistent application of the reporting requirement to businesses that handled appliances containing HFCs and PFCs as well as to businesses that handled appliances containing CFCs and HCFCs would reduce confusion and thereby minimize emissions of all four types of refrigerants.

H. Servicing Apertures

EPA prohibits the sale or distribution of CFC and HCFC appliances that are not equipped either with a process stub (in the case of small appliances) or with a servicing aperture (in the case of all other appliances) to facilitate refrigerant recovery. EPA is today proposing to extend this prohibition to the sale and distribution of appliances containing HFCs or PFCs. EPA believes that the rationale for requiring servicing apertures or process stubs on HFC and PFC appliances is the same as that for requiring these design features on CFC and HCFC appliances. Specifically, these features permit technicians to comply with the venting prohibition by making it much easier for them to attach recovery equipment to the refrigerant circuit and thereby recover the refrigerant properly. Thus, EPA is proposing to require these features in order to implement the venting prohibition.

I. Prohibition on Manufacture of One-Time Expansion Devices That Contain Other Than Exempted Refrigerants

In order to implement the venting prohibition as it applies to one-time expansion devices using refrigerants other than nitrogen or carbon dioxide (see discussion in section IV.A.1.b. above), EPA is proposing a provision that would prohibit their manufacture in or import into the U.S. EPA believes that a prohibition on manufacturing or importing the devices (which include self-chilling cans) is simultaneously the least burdensome and the most effective, efficient, and equitable way of carrying out the venting prohibition as it applies to them. As discussed earlier in section II.A., EPA believes that section 608(c)(2) implicitly provides the Agency authority to promulgate regulations as necessary to implement and enforce the statutory prohibition, and section 301(a)(1)(a) further supplements that authority. As discussed below, EPA believes that a ban on manufacture and import of the devices is the only practical way to implement the prohibition on venting of section 608(c)(2) of the Act and hence is necessary to implement and enforce that prohibition.[28]

First, a prohibition on manufacturing or importing the devices would not be unreasonably burdensome. One-time expansion devices function only by venting; one-time expansion devices containing other than exempted refrigerants therefore have no legal use, given the self-effectuating venting prohibition of 608(c)(2). Thus, a prohibition on manufacture and import would not interfere with any lawful use of the device or can. At the same time, any burden on potential manufacturers of the can either would not exist, because perfect implementation of the venting prohibition would reduce demand for the cans to zero, or, to the extent that it existed, would exist solely as a result of illegal activity on the part of consumers. Thus, any burden placed on the manufacturer by a ban on manufacturing should be discounted. In contrast, as discussed further below, efforts to stop use of the can would place heavy burdens both on consumers and on EPA.

Second, prohibiting the manufacture or import of cans containing other than exempted refrigerants would be both more effective and more efficient than attempting to prevent the use of such cans by millions of potential consumers. EPA estimates that the total market for canned beverages in the U.S. is 100 billion units per year. Thus, if self-chilling cans captured even a small percentage of this market, very large numbers of cans could be used. For instance, if self-chilling cans captured just one percent of the canned beverage market, one billion self-chilling cans per year could be used, potentially violating the venting prohibition one billion times. Potential consumers of the can would include virtually the entire U.S. population of 265 million people. Without a ban on manufacture, the huge number of potential violators and violations would make the venting prohibition extremely difficult to enforce. A massive outreach campaign would be required to inform the public of the environmental and legal implications of using the cans, and such a campaign would still miss some fraction of the population. Of course, such a campaign would also be very expensive. At the same time, enforcement against consumers who either ignored or were ignorant of the campaign would be very difficult, due to the large numbers of potential consumers and the unpredictable and widespread nature of potential violations. In contrast, outreach to and enforcement against potential manufacturers of the can would only have to reach a few targets, interdicting the cans at the top of the distribution pyramid.

Third, a prohibition on manufacturing or importing cans containing other than exempted refrigerants would be more equitable than an enforcement campaign against consumers who might not recognize the environmental and legal implications of using such cans. While consumers of such cans would be expected to be aware that they were releasing gas to the atmosphere, it might not be reasonable to expect them to be aware that the gas being released contributed significantly to global warming or that its release was illegal, particularly since opening the can and releasing the gas would be the only possible use of a legally purchased product. As noted above, even a massive outreach campaign is likely to miss some fraction of consumers, and given the very large underlying population, even a small fraction would be sizable. However, it is both reasonable and standard practice to hold manufacturers responsible for knowledge of and compliance with the environmental and other laws and regulations applicable to their products.

Thus, a ban on manufacture and import of cans containing other than exempted refrigerants is the only practical way to implement the venting prohibition as it applies to them. Moreover, there are a number of precedents for prohibiting the manufacture, sale, and/or distribution of appliances, other equipment, and refrigerants under section 608 in order to reduce refrigerant emissions. Sections 82.154 (j) and (k) prohibit the sale or distribution of appliances unless they possess servicing apertures or process stubs, and § 82.154(c) prohibits the manufacture or import of recycling or recovery equipment that is not certified. Sections 82.154(g) and (h) prohibit the sale of used ozone-depleting refrigerants that have not been reclaimed (with minor exceptions), and § 82.154(m) prohibits the sale of ozone-depleting refrigerants to uncertified individuals (again with minor exceptions). Sales restrictions were more appropriate than manufacturing bans in the latter cases because (1) a manufacturing ban could not apply to used refrigerants, and (2) purchase and use of ozone-depleting refrigerants by some individuals, in this case certified technicians, is legal.

J. Recordkeeping Requirements

EPA currently requires reporting and recordkeeping from the following persons and entities:

a. Persons Who Sell or Distribute Refrigerant

Persons who sell or distribute any CFC or HCFC refrigerant must retain invoices that indicate the name of the purchaser, the date of sale, and the quantity of refrigerant purchased. These records help the Agency to track refrigerant use and to verify compliance with the venting prohibition (§ 82.166(a)).

b. Technicians

Certified technicians must keep a copy of their certificate at their place of business. This permits EPA inspectors to determine whether a technician has been certified, as required by the regulations (§ 82.166(l)).

Technicians servicing equipment containing 50 or more pounds of CFC or HCFC refrigerant must provide the owner or operator of the appliance with an invoice that indicates the amount of refrigerant added to the appliance. These records permit owners or operators of appliances containing 50 or more pounds of refrigerant to determine whether they need to take action to comply with the leak repair provisions (§ 82.166(j)).

c. Appliance Owners

Owners of appliances containing 50 or more pounds of CFC or HCFC refrigerant must keep servicing records documenting the date and type of service, as well as the quantity of refrigerant added. These requirements ensure that owners can determine when they must take action under the leak repair requirements. In addition, equipment owners who decide not to repair leaks must develop and maintain a record of a plan that states that the equipment will be retired, replaced or retrofitted. The plan permits EPA

[28] EPA has also proposed to find that self-chilling cans using HFC–152a and HFC–134a are unaccepted under its SNAP program. If EPA promulgates a final rule including this finding, the manufacture of self-chilling cans using HFC–152a and HFC–134a will be prohibited unde SNAP.

inspectors to ensure that equipment owners intend to take action to reduce emissions and actually take such action (§ 82.166(k)).

d. Owners of Industrial Process Refrigeration

Owners of industrial process refrigeration equipment who wish to receive an extension or exclusion under the leak repair provisions are subject to the following reporting and recordkeeping requirements.

i. Those persons wishing to extend leak repair compliance beyond the required 30 days must maintain and submit to EPA information identifying the facility, the leak rate, the method used to determine the leak rate and full charge, the date a leak rate greater than allowable was discovered, the location of the leaks, any repair work completed thus far and date completed, a plan to fix other outstanding leaks to achieve allowable leak rate, reasons why greater than 30 days is needed, and an estimate of when repair work will be completed. Any dates and results of static and dynamic tests must also be maintained and submitted to EPA (§ 82.166(n)).

ii. Those persons wishing to extend retrofit compliance beyond the required one year must maintain and submit to EPA information identifying the facility, the leak rate, the method used to determine the leak rate and full charge, the date a leak rate of greater than the allowable rate was discovered, the location of leaks, any repair work that has been completed thus far and date completed, a plan to complete the retrofit or replacement of the system, the reasons why more than one year is necessary, the date of notification to EPA, an estimate of when retrofit or replacement work will be completed, if time changes for original estimates occur, documentation of the reason why, and the date of notification to EPA regarding a change in the estimate of when the work will be completed (§ 82.166(o)).

iii. Those persons wishing to exclude purged refrigerants that are destroyed from the annual leak rate calculations must maintain records on-site to support the amount of refrigerant claimed sent for destruction. These records must include flow rate, quantity or concentration of the refrigerant in the vent stream, and periods of purge flow (§ 82.166(p)).

iv. Those persons wishing to calculate the full charge of an affected appliance by establishing a range based on the best available data, regarding the normal operating characteristics and conditions for the appliance, must maintain records on-site to support the methodology used in selecting or modifying the particular range (§ 82.166(q)).

These requirements allow EPA to determine whether or not extensions and exclusions requested under the leak repair provisions are warranted.

e. Refrigerant Reclaimers

Refrigerant reclaimers must certify to EPA that they will comply with the rule's requirements and must submit lists of the equipment that they use to clean and analyze refrigerants. This information enables EPA to verify reclaimers' compliance with refrigerant purity standards and refrigerant emissions limits. In addition, refrigerant reclaimers must maintain records of the names and addresses of persons sending them material for reclamation and the quantity of material sent to them for reclamation. This information must be maintained on a transactional basis. Within 30 days of the end of the calendar year, reclaimers must report to EPA the total quantity of material sent to them that year for reclamation, the mass of refrigerant reclaimed that year, and the mass of waste products generated that year. These requirements help the Agency to track refrigerant use and to ensure compliance with the venting prohibition by both reclaimers and their customers (§ 82.166(g) and (h)).

f. Equipment Certification Organizations

Equipment testing organizations must apply to EPA to become approved. This application process is necessary to ensure that all approved testing laboratories have the equipment and expertise to test equipment to the applicable standards. Once approved, equipment testing organizations must maintain records of the tests performed and their results, and must submit a list of all certified equipment to EPA annually. Testing organizations must also notify EPA whenever a new model of equipment is certified or whenever an existing certified model fails a recertification test. This information is required to ensure that recycling and recovery equipment meets the performance standards of the regulation (§§ 82.160 and 82.166(c), (d), and (e)).

g. Disposers

Persons who conduct final disposal of small appliances, room air conditioners, and MVACs and who do not recover the refrigerant themselves must maintain copies of signed statements attesting that the refrigerant has been removed prior to final disposal of each appliance. These records help EPA to verify that refrigerant is recovered at some point during the disposal process even if the final disposer does not have recovery equipment (§ 82.166(i)).

h. Technician Certification Programs

Organizations operating technician certification programs must apply to EPA to have their programs approved. The application process ensures that the technician certification programs meet minimum standards for generating, tracking, and grading tests, and keeping records. Approved technician certification programs have to maintain records including the names of certified technicians and the unique numbers assigned to each technician certified through their programs. These records allow both the Agency and the certification program to verify certification claims and to monitor the certification process. Approved technician certification programs also have to submit to EPA reports every six months including the pass/fail rate and testing schedules. Such reports give the Agency the ability to evaluate certification programs and modify certification requirements if necessary (§ 82.166(f)).

EPA is proposing to extend all of these requirements, as applicable, to persons who sell or distribute HFC or PFC refrigerants, to technicians who service HFC or PFC appliances, to persons who own HFC or PFC appliances containing more than 50 pounds of refrigerant, to reclaimers that reclaim HFC or PFC refrigerants, to equipment certification organizations that certify recovery or recycling equipment for use with HFCs or PFCs, and to technician certification programs that certify technicians who work with HFCs or PFCs.

The rationale for requiring these records for persons who handle HFC or PFC refrigerants or equipment is the same as that set forth above for requiring such records for persons who handle CFC or HCFC refrigerants or equipment. In all cases, the records would be necessary to ensure compliance with the regulatory program implementing the section 608(c)(2) prohibition on venting and hence would be necessary to implement and enforce section 608(c)(2) and section 608(a) as well, for the provisions in this proposal that are authorized by that section. The records proposed to be required would make it possible for EPA both to monitor compliance and to enforce against violations.

V. Summary of Supporting Analyses

A. Executive Order 12866

Under Executive Order 12866 (58 FR 51735, October 4, 1993), the Agency must determine whether this regulatory action is ''significant'' and therefore subject to OMB review and the requirements of the Executive Order. The Order defines ''significant'' regulatory action as one that is likely to lead to a rule that may:

(1) Have an annual effect on the economy of $100 million or more, or adversely and materially affect a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities;

(2) Create a serious inconsistency or otherwise interfere with an action taken or planned by another agency;

(3) Materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or

(4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the Executive Order.

It has been determined by OMB and EPA that this proposed action to amendment to the final rule is not a ''significant regulatory action'' under the terms of Executive Order 12866 and is therefore not subject to OMB review under the Executive Order. Nevertheless, the Agency has performed a cost benefit analysis of this regulation, which is available for review in the public docket for this rulemaking. This analysis is summarized below.

1. Baseline

Since these regulations are being promulgated in addition to other provisions that affect the use of substitute refrigerants, the baseline for this analysis must reflect the state of affairs after the implementation of previous provisions and before the implementation of the final rule. The provision of the Clean Air Act that must be considered when defining the baseline for these regulations is the prohibition on venting contained in section 608(c)(2), which is self-effectuating. For the purposes of the analysis, EPA chose two variables to describe the effects of this provision: The percentage of the market in which recycling and recovery would occur as a result of the provision (referred to as either market penetration or compliance); and the average recapture efficiency of the recycling or recovery methods that would be employed by the complying population.

The self-effectuating prohibition on venting in section 608(c)(2) can be considered a minimal requirement to recycle because chemicals must be recycled, or at least stored, if they cannot be vented. However, because the prohibition on venting does not in itself contain standards, maximum recovery efficiency and full compliance would not be expected under the prohibition alone. Instead, recovery efficiency and compliance are likely to vary across sectors depending upon whether recycling is privately cost-effective in that sector. Recycling will be privately cost-effective in a sector when the value of the recovered refrigerant exceeds the labor and equipment costs for the recovery, as it does in sectors with large charge sizes. The cost-benefit analysis assumes that in those sectors where recycling is estimated to be privately cost-effective, compliance with the venting prohibition will be 100 percent, and recovery efficiency will be 95 percent. The figures are assumed to remain the same after imposition of the regulation. In those sectors where recycling is not estimated to be privately cost effective, including the household refrigeration, household air-conditioning, other appliance, and refrigerated transport sectors, compliance with the venting prohibition is assumed to be 80 percent, and recovery efficiencies are assumed to be 75 percent. These figures are assumed to rise to 100 percent and 90 percent respectively after imposition of the regulation.

2. Costs

The costs of the substitutes recycling rule consist of the costs of increased compliance with the venting prohibition (primarily labor costs), the costs of certifying recycling and recovery equipment, the costs of certifying technicians, the costs of the sales restriction, recordkeeping costs, and refrigerant storage costs. The Agency estimates the cost for this regulatory program over a 29-year period between 1996 and 2025 is $1,619 million using a 2% discount rate, and $782 million using a 7% discount rate.

3. Benefits

The benefits of the provisions discussed above consist of (1) avoided damage to air-conditioning and refrigeration equipment that would occur if, without regulation, contaminated refrigerants were charged into equipment, and (2) avoided damage to human health and the environment that would occur if, without regulation, environmentally harmful refrigerants were released rather than recaptured. EPA's estimate of human health and environmental benefits is based on (a) the estimates of the benefits of avoiding emissions of ozone-depleting compounds that were developed for the 1993 RIA, and (b) estimates of the benefits of avoiding emissions of global warming compounds that are derived from a ''The Social Costs of Greenhouse Gas Emissions: An Expected Value Approach.[29]'' This paper surveyed previous efforts to quantify the effects of global climate change and developed a technique for calculating the marginal impact of emitting a ton of carbon. Benefits quantified include reductions in damages from sea level rise, reduced agricultural yields, reduced water supply, and other impacts. The paper explicitly incorporated many of the uncertainties involved in developing the estimate and thereby developed lower-bound, best-estimate, and upper-bound values for the benefit of avoiding emissions of a ton of carbon. EPA adjusted these estimates to account for the facts that (1) U.S. benefits would only be a fraction of world-wide benefits and (2) on a kilogram-for-kilogram basis, the HFC and PFC refrigerants have many times the global warming potential of carbon.

As noted above, the analysis assumes that the rule increases both compliance with the venting prohibition and the efficiency of many recovery jobs. The Agency estimates the range of benefits to be from $1,060 million to $11,188 million, using the lower and upper bound estimates of the benefits of avoided equipment damage and of the domestic benefits of avoiding emission of a kilogram of refrigerant. These benefits were discounted at a 2% discount rate. The benefits range from $475 million to $5,615 million when discounted at a 7% discount rate.

B. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), P.L. 104–4, establishes requirements for Federal agencies to assess the effects of certain regulatory actions on State, local, and tribal governments and the private sector. Under sections 202 and 205 of the UMRA, EPA generally must prepare a written statement of economic and regulatory alternatives analyses for proposed and final rules with Federal mandates, as defined by the UMRA, that may result in expenditures to State, local, and tribal governments, in the aggregate, or to the private sector, of $100 million or more in any one year.

EPA has determined that this rule does not contain a Federal mandate that may result in expenditures of $100 million or more for State, local, and tribal governments in the aggregate, or

[29] Frankhauser, S. ''The Social Cost of Greenhouse Gas Emissions: An Expected Value Approach,'' *Energy Journal* 15(2), 1994, pp. 157–183.

the private sector, in any one year. As noted above, EPA's cost-benefit analysis concluded that the total annual costs of the rule will be less than $100 million per year. State, local, and tribal governments may have to pay some costs for refrigerant recycling when their air-conditioning and refrigeration equipment is serviced or disposed of, but these costs will be small. Moreover, most municipal solid waste facilities do not accept white goods and so will not be affected by the safe disposal provisions of the rule. Thus, today's proposed rule is not subject to the requirements of sections 202 and 205 of the UMRA.

For the reasons outlined above, EPA has also determined that this rule contains no regulatory requirements that might significantly or uniquely affect small governments. Thus, today's proposed rule is not subject to the requirements of section 203 of the UMRA.

C. Paperwork Reduction Act

This proposed rule has no new information requirements subject to the Paperwork Reduction Act.

D. Regulatory Flexibility

The Regulatory Flexibility Act (RFA) generally requires an agency to conduct a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements unless the agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small not-for-profit enterprises, and small governmental jurisdictions. EPA has concluded that this proposed rule would not have a significant impact on a substantial number of small entities.

EPA performed a detailed screening analysis in 1992 of the impact of the recycling regulation for ozone-depleting refrigerants on small entities. The methodology of this analysis is discussed at length in the May 14, 1993 regulation (58 FR 28710). EPA has updated that analysis to examine the impact of the recycling regulation for substitute refrigerants, and has concluded that this regulation will not have a significant impact on a substantial number of small entities. The methodology for the updated analysis is the same as for the initial analysis, except EPA has also considered the changing market share of HFC equipment and compliance with the venting prohibition that would occur in the absence of the rule. This approach makes the screening analysis more consistent with the cost-benefit analysis discussed above. In addition, EPA added an analysis of the potential impact of a sales restriction on HFC refrigerants on auto parts and supply stores that are small businesses.

In the updated screening analysis, EPA estimates that 118 small businesses may incur compliance costs in excess of 1% of their sales, while 39 small businesses may incur compliance costs in excess of 3% of their sales. These numbers respectively represent 0.1% and 0.03% of the 122,416 small businesses that EPA estimates are affected by the rule. Based on this analysis, EPA does not believe that this regulation will have a significant impact on a substantial number of small entities. Consequently, I hereby certify that this proposed rule will not have a significant adverse effect on a substantial number of small entities.

Although this rule will not have a significant adverse effect on a substantial number of small entities, EPA has made numerous efforts to involve small entities in the rulemaking process and to incorporate flexibility into the proposed rule for small entities, where appropriate. Efforts to involve small entities include the March 10, 1995, industry meeting, which included several trade groups representing small businesses, and a number of individual meetings with both small businesses and associations representing small businesses. EPA has also developed outreach materials, including fact sheets and a videotape, to help small businesses to comply with the existing refrigerant recycling regulations and the prohibition on venting of both ozone-depleting refrigerants and their substitutes.

Moreover, the proposed rule grants to small businesses working with substitute refrigerants the same flexibility that was granted to small businesses working with CFC and HCFC refrigerants (58 FR 28667–28669, 28712). Thus, for instance, the proposed rule would permit persons servicing small appliances (frequently small businesses) to use relatively inexpensive recovery equipment, and would establish a flexible program for the safe disposal of small appliances, MVACs, and MVAC-like appliances. In addition, the rule would permit HVAC/R contractors to recover HFCs using recycling and recovery equipment designed for use with CFCs and HCFCs, and would permit technicians certified to work with CFCs and HCFCs to work with HFCs with no further testing.

E. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 (''NTTAA''), Pub L. 104–113, section 12(d) (15 U.S.C. 272 note), directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (e.g., materials specifications, test methods, sampling procedures, business practices, etc.) that are developed or adopted by voluntary consensus standards bodies. The NTTAA requires EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

In this document, EPA is proposing to use voluntary consensus standards in all of the applications covered by the proposed regulations for which there are voluntary consensus standards available. Thus, EPA is proposing to use ARI Standard 740–1995, Standard for Refrigerant Recovery/Recycling Equipment, and ARI Standard 700–1995, Standard for Specifications for Fluorocarbon and Other Refrigerants. The first establishes requirements and test methods for refrigerant recovery and recycling equipment; the second establishes specifications and test methods for refrigerants. EPA invites public comment on whether there are other available and applicable voluntary consensus standards that the Agency should apply.

F. Children's Health Protection

This proposed rule is not subject to E.O. 13045, entitled ''Protection of Children from Environmental Health Risks and Safety Risks'' (62 FR 19885, April 23, 1997), because it does not involve decisions on environmental health risks or safety risks that may disproportionately affect children.

List of Subjects in 40 CFR Part 82

Environmental protection, Air pollution control, Contractors, Reclaimers, Reclamation, Recycling, Reporting and recordkeeping requirements, Technician.

Dated: May 28, 1998.

Carol M. Browner,

Administrator.

Title 40 of the Code of Federal Regulations, part 82, is proposed to be amended as follows:

PART 82—[AMENDED]

1. The authority citation for Part 82 continues to read as follows:

Authority: 42 U.S.C. 7414, 7601, 7671–7671q.

1a. Section 82.150 is amended by revising paragraph (a) to read as follows:

§ 82.150 Purpose and scope.

(a) The purpose of this subpart is to reduce emissions of class I and class II refrigerants to the lowest achievable level during the service, maintenance, repair, and disposal of appliances and to maximize compliance with the prohibition on venting of all refrigerants during the service, maintenance, repair, and disposal of appliances in accordance with section 608 of the Clean Air Act.

* * * * *

2. Section 82.152 is amended by adding definitions for ''higher-pressure appliance,'' ''leak rate,'' ''one-time expansion device,'' ''refrigerant,'' and ''substitute,'' and by revising the definitions for ''appliance,'' ''full charge,'' ''high-pressure appliance,'' ''low-pressure appliance,'' ''opening,'' ''reclaim,'' ''technician,'' and ''very-high-pressure appliance'' to read as follows:

§ 82.152 Definitions.

Appliance means any device which contains and uses a refrigerant and which is used for household or commercial purposes, including any air conditioner, refrigerator, chiller, or freezer.

* * * * *

Full charge means the amount of refrigerant required for normal operating characteristics and conditions of the appliance as determined by using one or a combination of the following four methods:

(1) Use the equipment manufacturer's determination of the correct full charge for the equipment;

(2) Determine the full charge by making appropriate calculations based on component sizes, density of refrigerant, volume of piping, and other relevant considerations;

(3) Use actual measurements of the amount of refrigerant added or evacuated from the appliance; and/or

(4) Use an established range based on the best available data regarding the normal operating characteristics and conditions for the appliance, where the mid-point of the range will serve as the full charge, and where records are maintained in accordance with § 82.166(q).

* * * * *

High-pressure appliance means an appliance that uses a refrigerant with a liquid phase saturation pressure between 45 psia and 220 psia at 104 degrees F. This definition includes but is not limited to appliances using R12, R114, R134a, R401A and B, and R500.

* * * * *

Higher-pressure appliance means an appliance that uses a refrigerant with a liquid phase saturation pressure between 220 psia and 305 psia at 104 degrees F. This definition includes but is not limited to appliances using R22, R502, R402A and B, and R407A, B, and C.

* * * * *

Leak rate means the rate at which an appliance is losing refrigerant, measured between refrigerant charges or over 12 months, whichever is shorter. The leak rate is expressed in terms of the percentage of the appliance's full charge that would be lost over a 12-month period if the current rate of loss were to continue over that period. The rate is calculated using the following method:

(1) Take the number of pounds of refrigerant added to the appliance to return it to a full charge and divide it by the number of pounds of refrigerant the appliance normally contains at full charge;

(2) Take the shorter of: (a) 365 days, and (b) the number of days that have passed since the last day refrigerant was added and divide that number by 365 days;

(3) Take the number calculated in step (1) and divide it by the number calculated in step (2); and

(4) Multiply the number calculated in step (3) by 100 to calculate a percentage.

This method is summarized in the following formula:

$$\text{Leak rate (\% per year)} = \frac{\text{pounds of refrigerant added}}{\text{pounds of refrigerant in full charge}} \times \frac{\text{365 days/year}}{\text{shorter of: \# days since refrigerant last added and 365 days}} \times 100\%$$

* * * * *

Low-pressure appliance means an appliance that uses a refrigerant with a liquid phase saturation pressure below 45 psia at 104 degrees Fahrenheit. This definition includes but is not limited to appliances using R11, R123, and R113.

* * * * *

One-time expansion device means an appliance that relies on the release of refrigerant to the environment to obtain cooling.

Opening an appliance means any service, maintenance, or repair on an appliance that would release refrigerant from the appliance to the atmosphere unless the refrigerant were recovered previously from the appliance. Connecting and disconnecting hoses and gauges to and from the appliance to measure pressures within the appliance and to add refrigerant to or recover refrigerant from the appliance shall not be considered ''opening.''

* * * * *

Reclaim refrigerant means to reprocess refrigerant to all of the specifications in appendix A to 40 CFR part 82, subpart F (based on ARI Standard 700–1995, Specification for Fluorocarbons and Other Refrigerants) that are applicable to that refrigerant and to verify that the refrigerant meets these specifications using the analytical methodology prescribed in appendix A. In general, reclamation involves the use of processes or procedures available only at a reprocessing or manufacturing facility.

* * * * *

Refrigerant means, for purposes of this Subpart, any class I or class II substance used for heat transfer purposes, or any substance used as a substitute for such a class I or class II substance by any user in a given end-use, except for the following substitutes in the following end-uses:

(1) Ammonia in commercial or industrial process refrigeration or in absorption units

(2) Hydrocarbons in industrial process refrigeration (processing of hydrocarbons)

(3) Chlorine in industrial process refrigeration (processing of chlorine and chlorine compounds)

(4) Carbon dioxide in any application

(5) Nitrogen in any application

(6) Water in any application

* * * * *

Substitute means any chemical or product substitute, whether existing or new, that is used by any person as a replacement for a class I or II compound in a given end-use.

* * * * *

Technician means any person who performs maintenance, service, or repair that could be reasonably expected to release refrigerants from appliances, except for MVACs, into the atmosphere. Technician also means any person who performs disposal of appliances, except for small appliances, MVACs, and MVAC-like appliances, that could be reasonably expected to release refrigerants from the appliances into the atmosphere. Performing maintenance, service, repair, or disposal could be reasonably expected to release refrigerants only if the activity is reasonably expected to violate the integrity of the refrigerant circuit. Activities reasonably expected to violate the integrity of the refrigerant circuit include activities such as attaching and detaching hoses and gauges to and from the appliance to add or remove refrigerant or to measure pressure and adding refrigerant to and removing refrigerant from the appliance. Activities such as painting the appliance, re-wiring an external electrical circuit, replacing insulation on a length of pipe, or tightening nuts and bolts on the appliance are not reasonably expected to violate the integrity of the refrigerant circuit. Performing maintenance, service, repair, or disposal of appliances that have been evacuated pursuant to § 82.156 could not be reasonably expected to release refrigerants from the appliance unless the maintenance, service, or repair consists of adding refrigerant to the appliance. Technician includes but is not limited to installers, contractor employees, in-house service personnel, and in some cases, owners.

Very-high-pressure appliance means an appliance that uses a refrigerant with a critical temperature below 104 degrees Fahrenheit or with a liquid phase saturation pressure above 305 psia at 104 degrees Fahrenheit. This definition includes but is not limited to appliances using R410A and B, R13, R23, and R503.

3. Section 82.154 is amended by revising paragraphs (a), (b), (c), (g), (h), and (m), and by adding paragraphs (o) and (p) to read as follows:

§ 82.154 Prohibitions.

(a) Effective (30 days after publication of the final rule), no person maintaining, servicing, repairing, or disposing of appliances may knowingly vent or otherwise release into the environment any refrigerant from such equipment. The knowing release of refrigerant subsequent to its recovery from an appliance shall be considered a violation of this prohibition. De minimis releases associated with good faith attempts to recycle or recover refrigerants are not subject to this prohibition. Releases shall be considered de minimis only if they occur when:

(1) The required practices set forth in § 82.156 are observed, recovery or recycling machines that meet the requirements set forth in § 82.158 are used, and the technician certification provisions set forth in § 82.161 are observed; or

(2) The requirements set forth in subpart B of this part are observed.

(b) No person may open appliances except MVACs and MVAC-like appliances for maintenance, service, or repair, and no person may dispose of appliances except for small appliances, MVACs, and MVAC-like appliances:

* * * * *

(c) No person may manufacture or import recycling or recovery equipment for use during the maintenance, service, or repair of appliances except MVACs and MVAC-like appliances, and no person may manufacture or import recycling or recovery equipment for use during the disposal of appliances except small appliances, MVACs, and MVAC-like appliances, unless the equipment is certified pursuant to § 82.158 (b) or (d), as applicable.

* * * * *

(g) No person may sell or offer for sale refrigerant consisting wholly or in part of used refrigerant unless:

(1) The refrigerant has been reclaimed as defined at § 82.152;

(2) The refrigerant was used only in an MVAC or MVAC-like appliance and is to be used only in an MVAC or MVAC-like appliance; or

(3) The refrigerant is contained in an appliance that is sold or offered for sale together with the refrigerant.

(h) No person may sell or offer for sale refrigerant consisting wholly or in part of used refrigerant unless:

(1) The refrigerant has been reclaimed by a person who has been certified as a reclaimer pursuant to § 82.164;

(2) The refrigerant was used only in an MVAC or MVAC-like appliance and is to be used only in an MVAC or MVAC-like appliance; or

(3) The refrigerant is contained in an appliance that is sold or offered for sale together with the refrigerant.

* * * * *

(m) No person may sell or distribute, or offer for sale or distribution, any refrigerant to any person unless:

* * * * *

(o) No person may manufacture or import one-time expansion devices.

(p) Recovery or recycling equipment certified or rated for use with only one refrigerant may not be used to recover other refrigerants.

4. Section 82.156 is amended by revising the introductory text of paragraph (a) to read as follows, by removing paragraph (a)(5), by revising Table 1 to read as follows, by revising paragraph (b) to read as follows, and by redesignating paragraphs (i)(1), (i)(1)(i), (i)(1)(ii) and (i)(1)(iii) as (i)(1)(i), (i)(1)(iii), (i)(1)(iv), and (i)(1)(v), by adding a new paragraph (i)(1)(ii), and by revising newly designated paragraphs (i)(1)(i) and (i)(1)(iii) to read as follows, by redesignating paragraphs (i)(2), (i)(2)(i), and (i)(2)(ii) as (i)(2)(i), (i)(2)(iii), and (i)(2)(iv), by adding a new paragraph (i)(2)(ii), and by revising newly designated paragraph (i)(2)(i) to read as follows, by redesignating paragraphs (i)(5), (i)(5)(i), (i)(5)(ii), and (i)(5)(iii), as (i)(5)(i), (i)(5)(iii), (i)(5)(iv), and (i)(5)(v), by adding a new paragraph (i)(5)(ii), and by revising newly designated paragraph (i)(5)(i) to read as follows, by revising paragraphs (i)(3), (i)(3)(i), (i)(3)(ii), and (i)(6) to read as follows, and by replacing the phrase ''annual leak rate'' with ''leak rate'' throughout:

§ 82.156 Required Practices.

(a) All persons disposing of appliances, except for small appliances, MVACs, and MVAC-like appliances must evacuate the refrigerant, including all the liquid refrigerant, in the entire unit to a recovery or recycling machine certified pursuant to § 82.158. All persons opening appliances except for MVACs and MVAC-like appliances for maintenance, service, or repair must evacuate the refrigerant, including all the liquid refrigerant (except as provided in paragraph (a)(2)(i)(B) of this section), in either the entire unit or the part to be serviced (if the latter can be isolated) to a system receiver (e.g., the remaining portions of the appliance, or a specific vessel within the appliance) or a recovery or recycling machine certified pursuant to § 82.158. Certified technicians must verify that the applicable level of evacuation has been reached in the appliance or the part before it is opened.

* * * * *

TABLE 1.—REQUIRED LEVELS OF EVACUATION FOR APPLIANCES

[Except for small appliances, MVACs, and MVAC-like appliances]

Type of appliance	Inches of Hg vacuum (relative to standard atmospheric pressure of 29.9 inches Hg)	
	Using recovery or recycling equipment manufactured or imported before Nov. 15, 1993	Using recovery or recycling equipment manufactured or imported on or after Nov. 15, 1993
Very high-pressure appliance	0	0.
Higher-pressure appliance, or isolated component of such appliance, normally containing less than 200 pounds of refrigerant.	0	0.
Higher-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant.	4	10.
High-pressure appliance, or isolated component of such appliance, normally containing less than 200 pounds of refrigerant.	4	10.
High-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant.	4	15.
Low-pressure appliance	25	25 mm Hg absolute.

* * * * *

(b) All persons opening appliances except for small appliances, MVACs, and MVAC-like appliances for maintenance, service, or repair and all persons disposing of appliances except small appliances, MVACs, and MVAC-like appliances must have at least one piece of certified, self-contained recovery or recycling equipment available at their place of business. Persons who maintain, service, repair, or dispose of only appliances that they own and that contain pump-out units are exempt from this requirement. This exemption does not relieve such persons from other applicable requirements of § 82.156.

* * * * *

(i)(1)(i) Owners or operators of commercial refrigeration equipment normally containing more than 50 pounds of refrigerant and commissioned before or during 1992 must have leaks repaired in accordance with paragraph (i)(9) of this section if the leak rate of the appliance exceeds 15 percent per year, except as described in paragraphs (i)(6), (i)(8), and (i)(10) of this section and paragraphs (i)(1)(iii), (i)(1)(iv), and (i)(1)(v) of this section. Repairs must bring the leak rate to or below 15 percent per year.

(ii) Owners or operators of commercial refrigeration equipment normally containing more than 50 pounds of refrigerant and commissioned after 1992 must have leaks repaired in accordance with paragraph (i)(9) of this section if the leak rate of the appliance exceeds 10 percent per year, except as described in paragraphs (i)(6), (i)(8), and (i)(10) of this section and paragraphs (i)(1)(iii), (i)(1)(iv), and (i)(1)(v) of this section. Repairs must bring the leak rate to or below 10 percent per year.

(iii) If the owners or operators of federally-owned commercial refrigeration appliances determine that the leaks cannot be repaired in accordance with paragraph (i)(9) of this section and that an extension in accordance with the requirements discussed in this paragraph (i)(1)(iii) of this section applies, they must document all repair efforts and notify EPA of the reason for their inability to comply within the 30-day repair period in accordance with section 82.166(n). Such notification must be made within 30 days of discovering the leaks. EPA will determine if the extension requested in accordance with the requirements discussed in this paragraph (i)(1)(iii) of this section is justified. If the extension is not justified, EPA will notify the owner/operator within 30 days of receipt of the notification.

* * * * *

(2)(i) The owners or operators of industrial process refrigeration equipment normally containing more than 50 pounds of refrigerant must have leaks repaired in accordance with paragraph (i)(9) of this section if the leak rate of the appliance exceeds 20 percent per year, except as described in paragraphs (i)(6), (i)(7), and (i)(10) of this section, and paragraphs (i)(2)(ii), (i)(2)(iii) and (i)(2)(iv) of this section. Repairs must bring the leak rate to or below 20 percent per year. If the owners or operators of the industrial process refrigeration equipment determine that the leak rate cannot be brought to or below 20 percent per year within 30 days (or 120 days, where an industrial process shutdown in accordance with paragraph (i)(2)(iv) of this section is required) and in accordance with paragraph (i)(9) of this section, and that an extension in accordance with the requirements discussed in this paragraph applies, the owners or operators of the appliance must document all repair efforts and notify EPA of the reason for the inability in accordance with § 82.166(n). Such notification must be made within 30 days of making the determination. Owners or operators who obtain an extension pursuant to this section or elect to utilize the additional time provided in paragraph (i)(2)(iii) of this section must conduct all necessary leak repairs, if any, that can be performed within 30 days of discovering the leaks.

(ii) Notwithstanding the provisions of paragraph (i)(2)(i) of this section, a maximum allowable leak rate of 35 percent per year shall apply to industrial process refrigeration systems meeting all of the following conditions:

(A) The refrigeration system is custom-built;

(B) The refrigeration system has an open-drive compressor;

(C) The refrigeration system was built in 1992 or before; and

(D) The system is direct-expansion (contains a single, primary refrigerant loop).

* * * * *

(3) Owners or operators of federally-owned commercial refrigeration

equipment or of federally-owned comfort cooling appliances who are granted additional time under paragraphs (i)(1) or (i)(5) of this section, and owners or operators of industrial process refrigeration equipment, must have repairs performed in a manner that sound professional judgment indicates will bring the leak rate below the applicable allowable leak rate. When an industrial process shutdown has occurred or when repairs have been made while an appliance is mothballed, the owners or operators shall conduct an initial verification test at the conclusion of the repairs and a follow-up verification test. The follow-up verification test shall be conducted within 30 days of completing the repairs or within 30 days of bringing the appliance back on-line, if taken off-line, but no sooner than when the appliance has achieved normal operating characteristics and conditions. When repairs have been conducted without an industrial process shutdown or system mothballing, an initial verification test shall be conducted at the conclusion of the repairs, and a follow-up verification test shall be conducted within 30 days of the initial verification test. In all cases, the follow-up verification test shall be conducted at normal operating characteristics and conditions, unless sound professional judgment indicates that tests performed at normal operating characteristics and conditions will produce less reliable results, in which case the follow-up verification test shall be conducted at or near the normal operating pressure where practicable, and at or near the normal operating temperature where practicable.

(i) If the owners or operators of federally-owned commercial refrigeration equipment or of federally-owned comfort cooling appliances who are granted additional time under paragraphs (i)(1) or (i)(5) of this section take the appliances off-line, or if owners or operators of industrial process refrigeration equipment take the appliances off-line, they cannot bring the appliances back on-line until an initial verification test indicates that the repairs undertaken in accordance with paragraphs (i)(1) (i), (ii), (iii), (iv), or (v), or (i)(2) (i), (ii), or (iii) or (5) (i), (ii), and (iii) of this section have been successfully completed, demonstrating the leak or leaks are repaired. The owners or operators of the industrial process refrigeration equipment, federally-owned commercial refrigeration equipment, or federally-owned comfort cooling appliances are exempted from this requirement only where the owners or operators will retrofit or retire the industrial process refrigeration equipment, federally-owned commercial refrigeration equipment, or federally-owned comfort cooling appliances in accordance with paragraph (i)(6) of this section. Under this exemption, the owner or operators may bring the industrial process refrigeration equipment, federally-owned commercial refrigeration equipment, or federally-owned comfort cooling appliances back on-line without successful completion of an initial verification test.

(ii) If the follow-up verification test indicates that the repairs to industrial process refrigeration equipment, federally-owned commercial refrigeration equipment, or federally-owned comfort cooling appliances have not been successful, the owner must retrofit or retire the equipment in accordance with paragraph (i)(6) and any such longer time period as may apply under paragraphs (i)(7) (i), (ii) and (iii) or (i)(8) (i) and (ii) of this section. The owners and operators of the industrial process refrigeration equipment, federally-owned commercial refrigeration equipment, or federally-owned comfort cooling appliances are relieved of this requirement if the conditions of paragraphs (i)(3)(iv) and/ or (i)(3)(v) of this section are met.

* * * * *

(5)(i) Owners or operators of appliances normally containing more than 50 pounds of refrigerant, manufactured before or during 1992, and not covered by paragraphs (i)(1) or (i)(2) of this section must have leaks repaired in accordance with paragraph (i)(9) of this section if the leak rate of the appliance exceeds 10 percent per year, except as provided in paragraphs (i)(5)(iii), (i)(5)(iv), and (i)(5)(v) of this section. Repairs must bring the leak rate to or below 10 percent per year.

(5)(ii) Owners or operators of appliances normally containing more than 50 pounds of refrigerant, manufactured after 1992, and not covered by paragraphs (i)(1) or (i)(2) of this section must have leaks repaired in accordance with paragraph (i)(9) of this section if the leak rate of the appliance exceeds 5 percent per year, except as provided in paragraphs (i)(5)(iii), (i)(5)(iv), and (i)(5)(v) of this section. Repairs must bring the leak rate to or below 5 percent per year.

* * * * *

(6) Owners or operators are not required to repair leaks as provided in paragraphs (i)(1), (i)(2), and (i)(5) of this section if, within 30 days of discovering the exceedance of the applicable allowable leak rate, or within 30 days of a failed follow-up verification test, or after making good faith efforts to repair the leaks as described in paragraph (i)(6)(i) of this section, they develop a one-year retrofit or retirement plan for the leaking appliance. Owners or operators who retrofit the appliance must use a refrigerant with a lower ozone-depleting potential than the previous refrigerant and must include such a change in the retrofit plan. Owners or operators who retire and replace the appliance must replace the appliance with an appliance that uses a refrigerant with a lower ozone-depleting potential and must include such a change in the retirement plan. The retrofit or retirement plan (or a legible copy) must be kept at the site of the appliance. The original plan must be made available for EPA inspection upon request. The plan must be dated and all work performed in accordance with the plan must be completed within one year of the plan's date, except as described in paragraphs (i)(6)(i), (i)(7), and (i)(8) of this section. Owners or operators are temporarily relieved of this obligation if the appliance has undergone system mothballing as defined in § 82.152.

(i) If the owner or operator has made good faith efforts to repair leaks from the appliance in accordance with paragraphs (i)(1), (i)(2), or (i)(5) of this section, and has decided, before completing a follow-up verification test, to retrofit or retire the appliance in accordance with paragraph (i)(6) of this section, the owner or operator must develop a retrofit or retirement plan within 30 days of the decision to retrofit or retire the appliance. The owner or operator must retrofit or retire the appliance within one year and 30 days of when the owner or operator discovered that the leak rate exceeded the applicable allowable leak rate, except as provided in paragraphs (i)(7) and (i)(8) of this section.

* * * * *

5. Section 82.158 is amended by revising Table 2 and Table 3, by removing paragraphs (f) and (g), and by redesignating paragraphs (h) through (m) as (f) through (k) to read as follows:

§ 82.158 Standards for recycling and recovery equipment.

* * * * *

TABLE 2.—LEVELS OF EVACUATION WHICH MUST BE ACHIEVED BY RECOVERY OR RECYCLING EQUIPMENT INTENDED FOR USE WITH APPLIANCES [1] MANUFACTURED ON OR AFTER NOVEMBER 15, 1993

Type of appliance with which recovery or recycling machine is intended to be used	Inches of vacuum (relative to standard atmospheric pressure of 29.9 inches of Hg)
Very high-pressure appliance	0
Higher-pressure appliance or isolated component of such appliance, normally containing less than 200 pounds of refrigerant	0
Higher-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant	10
High-pressure appliance, or isolated component of such appliance, normally containing less than 200 pounds of refrigerant	10
High-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant	15
Low-pressure appliance	[2] 25

[1] Except for small appliances, MVACs, and MVAC-like appliances.
[2] mm Hg absolute.

The vacuums specified in inches of Hg vacuum must be achieved relative to an atmospheric pressure of 29.9 inches of Hg absolute.

* * * * *

TABLE 3.—LEVELS OF EVACUATION WHICH MUST BE ACHIEVED BY RECOVERY OR RECYCLING EQUIPMENT INTENDED FOR USE WITH APPLIANCES [1] MANUFACTURED BEFORE NOVEMBER 15, 1993

Type of appliance with which recovery or recycling machine is intended to be used	Inches of vacuum (relative to standard atmospheric pressure of 29.9 inches of Hg)
Very high-pressure appliance	0
Higher-pressure appliance or isolated component of such appliance, normally containing less than 200 pounds of refrigerant	0
Higher-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant	4
High-pressure appliance, or isolated component of such appliance, normally containing less than 200 pounds of refrigerant	4
High-pressure appliance, or isolated component of such appliance, normally containing 200 pounds or more of refrigerant	4
Low-pressure appliance	[2] 25

[1] Except for small appliances, MVACs, and MVAC-like appliances.
[2] mm Hg absolute.

The vacuums specified in inches of Hg vacuum must be achieved relative to an atmospheric pressure of 29.9 inches of Hg absolute.

* * * * *

6. Section 82.161 is amended by revising paragraph (a)(2) as follows:

§ 82.161 Technician Certification.

(a) * * *

(2) Technicians who maintain, service, or repair high-, higher-, or very high-pressure appliances, except small appliances, MVACs, and MVAC-like appliances, or dispose of high-, higher-, or very high-pressure appliances, except small appliances, MVACs, and MVAC-like appliances, must be properly certified as Type II technicians.

* * * * *

7. Section 82.164 is amended by revising the introductory text and paragraphs (a), (b), and (e)(3) to read as follows:

§ 82.164 Reclaimer Certification.

Effective [INSERT DATE 30 DAYS AFTER PUBLICATION OF THE FINAL RULE] all persons reclaiming used refrigerant for sale to a new owner, except for persons who properly certified under this section prior to [INSERT DATE 30 DAYS AFTER PUBLICATION OF THE FINAL RULE] must certify to the Administrator that such person will:

(a) Reprocess refrigerant to all of the specifications in appendix A of this Subpart (based on ARI Standard 700–1995, Specification for Fluorocarbons and Other Refrigerants) that are applicable to that refrigerant;

(b) Verify that the refrigerant meets these specifications using the analytical methodology prescribed in appendix A;

* * * * *

(e) * * *

(3) The owner or a responsible officer of the reclaimer must sign the certification stating that the refrigerant will be reprocessed to all of the specifications in appendix A of this Subpart (based on ARI Standard 700–1995, Specification for Fluorocarbons and Other Refrigerants) that are applicable to that refrigerant, that the refrigerant's conformance to these specifications will be verified using the analytical methodology prescribed in appendix A, that no more than 1.5 percent of the refrigerant will be released during the reclamation process, that wastes from the reclamation process will be properly disposed of, and that the information given is true and correct. The certification should be sent to the following address: Section 608 Recycling Program Manager, Reclaimer Certification, Stratospheric Protection Division (6205J), U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460.

* * * * *

8. Section 82.166 is amended by revising paragraphs (a), (b), (n), (o)(4), (o)(7), (o)(8), and (o)(10) to read as follows:

§ 82.166 Reporting and recordkeeping requirements.

(a) All persons who sell or distribute any refrigerant must retain invoices that indicate the name of the purchaser, the date of sale, and the quantity of refrigerant purchased.

(b) Purchasers of refrigerant who employ certified technicians may provide evidence that at least one technician is properly certified to the wholesaler who sells them refrigerant; the wholesaler must then keep this information on file and may sell refrigerant to the purchaser or his authorized representative even if such purchaser or authorized representative is not a properly certified technician. In such cases, the purchaser must notify the wholesaler in the event that the purchaser no longer employs at least one properly certified technician. The wholesaler is then prohibited from selling refrigerants to the purchaser until such time as the purchaser employs at least one properly certified technician. At that time, the purchaser must provide new evidence that at least one technician is properly certified.

* * * * *

(n) The owners or operators of appliances must maintain on-site and report to EPA at the address listed in § 82.160 the information specified in paragraphs (n)(1), (n)(2), and (n)(3) of this section, within the time lines specified under § 82.156 (i)(1), (i)(2), (i)(3) and (i)(5) where such reporting and recordkeeping is required. This information must be relevant to the affected appliance.

(1) An initial report to EPA under § 82.156(i)(1)(iii), (i)(2)(i), or (i)(5)(iii) regarding why more than 30 days are needed to complete repairs must include: Identification of the facility; the leak rate; the method used to determine the leak rate and full charge; the date a leak rate above the applicable allowable leak rate was discovered; the location of leaks(s) to the extent determined to date; any repair work that has been completed thus far and the date that work was completed; the reasons why more than 30 days are needed to complete the work and an estimate of when the work will be completed. If changes from the original estimate of when work will be completed result in extending the completion date from the date submitted to EPA, the reasons for these changes must be documented and submitted to EPA within 30 days of discovering the need for such a change.

(2) If the owners or operators intend to establish that the appliance's leak rate does not exceed the applicable allowable leak rate in accordance with § 82.156(i)(3)(v), the owner or operator must submit a plan to fix other outstanding leaks for which repairs are planned but not yet completed to achieve a rate below the applicable allowable leak rate. A plan to fix other outstanding leaks in accordance with § 82.156(i)(3)(v) must include the following information: the identification of the facility; the leak rate; the method used to determine the leak rate and full charge; the date a leak rate above the applicable allowable leak rate was discovered; the location of leaks(s) to the extent determined to date; and any repair work that has been completed thus far, including the date that work was completed. Upon completion of the repair efforts described in the plan, a second report must be submitted that includes the date the owner or operator submitted the initial report concerning the need for additional time beyond the 30 days and notification of the owner or operator's determination that the leak rate no longer exceeds the applicable allowable leak rate. This second report must be submitted within 30 days of determining that the leak rate no longer exceeds the applicable allowable leak rate.

(3) Owners or operators must maintain records of the dates and types of all initial and follow-up verification tests performed under § 82.156(i)(3) and the test results for all follow-up verification tests. Owners or operators must submit this information to EPA within 30 days after conducting each test where required under § 82.156 (i)(1), (i)(2), (i)(3) and (i)(5). These reports must also include: identification of the facility; the leak rate; the method used to determine the leak rate and full charge; the date a leak rate above the applicable allowable leak rate was discovered; the location of leaks(s) to the extent determined to date; and any repair work that has been completed thus far and the date that work was completed.

* * * * *

(o) * * *

(4) The date a leak rate above the applicable allowable rate was discovered.

* * * * *

(7) A plan to complete the retrofit or retirement of the system;

(8) The reasons why more than one year is necessary to retrofit or retire the system;

* * * * *

(10) An estimate of when retrofit or retirement work will be completed. If the estimated date of completion changes from the original estimate and results in extending the date of completion, the owner or operator must submit to EPA the new estimated date of completion and documentation of the reason for the change within 30 days of discovering the need for the change, and must retain a dated copy of this submission.

* * * * *

(q) Owners or operators who choose to determine the full charge, as defined in § 82.152, of an affected appliance by using an established range or by using that method in combination with other methods for determining the full charge must maintain the following information:

* * * * *

9. Appendix A to subpart F is revised to read as follows:

Appendix A—Specifications for Fluorocarbons and Other Refrigerants

This appendix is based on Air-Conditioning and Refrigeration Institute Standard 700–1995.

Section 1. Purpose

1.1 *Purpose.* The purpose of this standard is to evaluate and accept/reject refrigerants regardless of source (new, reclaimed and/or repackaged) for use in new and existing refrigeration and air-conditioning products.

1.1.1 *Intent.* This standard is intended for the guidance of the industry including manufacturers, refrigerant reclaimers, repackagers, distributors, installers, servicemen, contractors and for consumers.

1.1.2 *Review and Amendment.* This standard is subject to review and amendment as the technology advances.

Section 2. Scope

2.1 *Scope.* This standard specifies acceptable levels of contaminants (purity requirements) for various fluorocarbon and other refrigerants regardless of source and lists acceptable test methods. These refrigerants are R11; R12; R13; R22; R23; R32; R113; R114; R123; R124; R125; R134a; R143a; R401A; R401B; R402A; R402B; R404A; R405A; R406A; R407A; R407B; R407C; R408A; R409A; R410A; R410B; R411A; R411B; R412A; R500; R502; R503; R507; R508; and R509 as referenced in the ANSI/ASHRAE Standard 34–1992. (American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., Standard 34–1992). Copies may be obtained from ASHRAE Publications Sales, 1791 Tullie Circle, NE, Atlanta, GA 30329. Copies may also be inspected at Public Docket No. A–92–01, Waterside Mall (Ground Floor) Environmental Protection Agency, 401 M Street, SW, Washington, DC in room M–1500.

Section 3. Definitions

3.1 *''Shall,'' ''Should,'' ''Recommended,'' or ''It Is Recommended.''* ''Shall,'' ''should,'' ''recommended,'' or ''it is recommended'' shall be interpreted as follows:

3.1.1 *Shall.* Where ''shall'' or ''shall not'' is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.

3.1.2 *Should, Recommended,* or *It is Recommended.* ''Should '', ''recommended'', or ''it is recommended'' is used to indicate provisions which are not mandatory but which are desirable as good practice.

Section 4. Characterization of Refrigerants and Contaminants

4.1 *Characterization.* Characterization of refrigerants and contaminants addressed are listed in the following general classifications:

4.1.1 *Characterization*

a. Gas Chromatography

b. Boiling point and boiling point range

4.1.2 *Contaminants*

a. Water

b. Chloride

c. Acidity

d. High boiling residue

e. Particulates/solids

f. Non-condensables

g. Impurities including other refrigerants

Section 5. Sampling, Summary of Test Methods and Maximum Permissible Contaminant Levels

5.1 *Referee Test.* The referee test methods for the various contaminants are summarized in the following paragraphs. Detailed test procedures are included in *Appendix-C to ARI Standard 700–95: Analytical Procedures for ARI Standard 700–95,* 1995, Air-Conditioning and Refrigeration Institute. *Appendix C to ARI Standard 700–95* is incorporated by reference. [This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies may be obtained from the Air-Conditioning and Refrigeration Institute, 4301 North Fairfax Drive, Arlington, Virginia 22203. Copies may also be inspected at Public Docket No. A–92–01, Waterside Mall (Ground Floor) Environmental Protection Agency, 401 M Street, SW, Washington, DC in room M–1500 or at the Office of the Federal Register, 800 North Capitol Street, NW, Suite 700, Washington, DC.] If alternative test methods are employed, the user must be able to demonstrate that they produce results equivalent to the specified referee method.

5.2 *Refrigerant Sampling.*

5.2.1 *Sampling Precautions.* Special precautions should be taken to assure that representative samples are obtained for analysis. Sampling shall be done by trained laboratory personnel following accepted sampling and safety procedures.

5.2.2 *Gas Phase Sample.* A gas phase sample shall be obtained for determining the non-condensables. Since non-condensable gases, if present, will concentrate in the vapor phase of the refrigerant, care must be exercised to eliminate introduction of air during the sample transfer. Purging is not an acceptable procedure for a gas phase sample since it may introduce a foreign product. Since R11, R113, and R123 have normal boiling points at or above room temperature, non-condensable determination is not required for these refrigerants.

5.2.2.1 *Connection.* The sample cylinder shall be connected to an evacuated gas sampling bulb by means of a manifold. The manifold should have a valve arrangement that facilitates evacuation of all connecting tubing leading to the sampling bulb.

5.2.2.2 *Equalizing Pressures.* After the manifold has been evacuated, close the valve to the pump and open the valve on the system. Allow the pressure to equilibrate and close valves.

5.2.3 *Liquid Phase Sample.* A liquid phase sample is required for all tests listed in this standard except the test for non-condensables.

5.2.3.1 *Preparation.* Place a clean, empty sample cylinder with the valve open in an oven at 110° C (230° F) for one hour. Remove it from the oven while hot, immediately connect to an evacuation system and evacuate to less than 1 mm mercury (1000 microns). Close the valve and allow it to cool. Weigh the empty cylinder.

5.2.3.2 Manifolding. The valve and lines from the unit to be sampled shall be clean and dry. The cylinder shall be connected to an evacuated gas sampling cylinder by means of a manifold. The manifold should have a valve arrangement that facilitates evacuation of all connecting tubing leading to the sampling cylinder.

5.2.3.3 Liquid Sampling. After the manifold has been evacuated, close the valve to the pump and open the valve on the system. Take the sample as a liquid by chilling the sample cylinder slightly. Accurate analysis requires that the sample container be filled to at least 60% by volume, however under no circumstances should the cylinder be filled to more than 80% by volume. This can be accomplished by weighing the empty cylinder and then the cylinder with refrigerant. When the desired amount of refrigerant has been collected, close the valve(s) and disconnect the sample cylinder immediately.

5.2.3.4 Record Weight. Check the sample cylinder for leaks and record the gross weight.

5.3 Refrigerant Characterization.

5.3.1 Primary Method. The primary method shall be gas chromatography (GC) as described in Appendix-C to ARI Standard 700–95. The chromatogram of the sample shall be compared to known standards.

5.3.2 Alternative Method. Determination of the boiling point and boiling point range is an acceptable alternative test method which can be used to characterize refrigerants. The test method shall be that described in the Federal Specification for ''Fluorocarbon Refrigerants,'' BB–F–1421 B, dated March 5, 1982, section 4.4.3.

5.3.3 Required Values. The required values for boiling point and boiling point range are given in Table 1A, Physical Properties of Single Component Refrigerants; Table 1B, Physical Properties of Zeotropic Blends (400 Series Refrigerants); and Table 1C, Physical Properties of Azeotropic Blends (500 Series Refrigerants).

5.4 Water Content.

5.4.1 Method. The Coulometric Karl Fischer Titration shall be the primary test method for determining the water content of refrigerants. This method is described in Appendix-C to ARI Standard 700–95. This method can be used for refrigerants that are either a liquid or a gas at room temperature, including refrigerants 11, 113, and 123. For all refrigerants, the sample for water analysis shall be taken from the liquid phase of the container to be tested. Proper operation of the analytical method requires special equipment and an experienced operator. The precision of the results is excellent if proper sampling and handling procedures are followed. Refrigerants containing a colored dye can be successfully analyzed for water using this method.

5.4.2 Limits. The value for water content shall be expressed as parts per million by weight and shall not exceed the maximum specified (see Tables 1A, 1B, and 1C).

5.5 Chloride. The refrigerant shall be tested for chloride as an indication of the presence of hydrochloric acid and/ or metal chlorides. The recommended procedure is intended for use with new or reclaimed refrigerants. Significant amounts of oil may interfere with the results by indicating a failure in the absence of chloride.

5.5.1 Method. The test method shall be that described in Appendix-C to ARI Standard 700–95. The test will show noticeable turbidity at chloride levels of about 3 ppm by weight or higher.

5.5.2 Turbidity. The results of the test shall not exhibit any sign of turbidity. Report the results as ''pass'' or ''fail.''

5.6 Acidity.

5.6.1 Method. The acidity test uses the titration principle to detect any compound that is highly soluble in water and ionizes as an acid. The test method shall be that described in Appendix-C to ARI Standard 700–95. This test may not be suitable for determination of high molecular weight organic acids; however these acids will be found in the high boiling residue test outlined in 5.7. The test requires a 100 to 120 gram sample and has a detection limit of 0.1 ppm by weight calculated as HCl.

5.6.2 Limits. The maximum permissible acidity is 1 ppm by weight as HCl.

5.7 High Boiling Residue.

5.7.1 Method. High boiling residue shall be determined by measuring the residue of a standard volume of refrigerant after evaporation. The refrigerant sample shall be evaporated at room temperature or at a temperature 45°C (115°F) for all refrigerants, except R113 which shall be evaporated at 60°C (140°F), using a Goetz bulb as specified in Appendix-C to ARI Standard 700–95. Oils and/or organic acids will be captured by this method.

5.7.2 Limits. The value for high boiling residue shall be expressed as a percentage by volume and shall not exceed the maximum percent specified (see Tables 1A, 1B, and 1C). An alternative gravimetric method is described in Appendix-C to ARI Standard 700–95.

5.8 Method of Tests for Particulates and Solids.

5.8.1 Method. A measured amount of sample is evaporated from a Goetz bulb under controlled temperature conditions. The particulates/solids shall be determined by visual examination of the Goetz bulb prior to the evaporation of refrigerant. Presence of dirt, rust or other particulate contamination is reported as ''fail.'' For details of this test method, refer to Part 3 of Appendix-C to ARI Standard 700–95.

5.9 Non-Condensables.

5.9.1 Sample. A vapor phase sample shall be used for determination of non-condensables. Non-condensable gases consist primarily of air accumulated in the vapor phase of refrigerants. The solubility of air in the refrigerants liquid phase is extremely low and air is not significant as a liquid phase contaminant. The presence of non-condensable gases may reflect poor quality control in transferring refrigerants to storage tanks and cylinders.

5.9.2 Method. The test method shall be gas chromatography with a thermal conductivity detector as described in Appendix-C to ARI Standard 700–95.

5.9.3 Limit. The maximum level of non-condensables in the vapor phase of a refrigerant in a container shall not exceed 1.5% by volume (see Tables 1A, 1B, and 1C).

5.10 Impurities, including Other Refrigerants.

5.10.1 Method. The amount of other impurities including other refrigerants in the subject refrigerant shall be determined by gas chromatography as described in Appendix-C to ARI Standard 700–95.

5.10.2 Limit. The subject refrigerant shall not contain more than 0.5% by weight of impurities including other refrigerants (see Tables 1A, 1B, and 1C).

Section 6. Reporting Procedure

6.1 Reporting Procedure. The source (manufacturer, reclaimer or repackager) of the packaged refrigerant shall be identified. The refrigerant shall be identified by its accepted refrigerant number and/or its chemical name. Maximum permissible levels of contaminants are shown in Tables 1A, 1B, and 1C. Test results shall be tabulated in a like manner.

TABLE 1A.—PHYSICAL PROPERTIES OF SINGLE COMPONENT REFRIGERANTS

	Reporting units	Reference (sub-clause)	R11	R12	R13	R22	R23	R32	R113	R114	R123	R124	R125	R134a	R143a
Characteristics*:															
Boiling Point*	°F @ 1.00 atm		74.9	−21.6	−114.6	−41.4	−115.7	−61.1	117.6	38.8	82.6	12.2	−55.3	−15.1	−52.6
	°C @ 1.00 atm		23.8	−29.8	−81.4	−40.8	−82.1	−51.7	47.6	3.8	27.9	−11.0	−48.5	−26.2	−47.0
Boiling Point Range*	K		0.3	0.3	0.5	0.3	0.5	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Typical Isomer Content	by weight								0–1% R113a	0–30% R-114a	0–8% R123a	0–5% R-124a	N/A	0–5000 ppm R-134	0–100 ppm R-143
Vapor Phase Contaminants:															
Air and other non-condensables.	% by volume @ 25 °C	5.9	N/A**	1.5	1.5	1.5	1.5	1.5	N/A**	1.5	N/A**	1.5	1.5	1.5	1.5
Liquid Phase Contaminants:															
Water	ppm by weight	5.4	20	10	10	10	10	10	20	10	20	10	10	10	10
All other impurities including refrigerants.	% by weight	5.1	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
High boiling residue	% by volume	5.7	0.01	0.01	0.05	0.01	0.01	0.01	0.03	0.01	0.01	0.01	0.01	0.01	0.01
Particulates/solids	Visually clean to pass	5.8	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass
Acidity	ppm by weight	5.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chlorides***	No visible turbidity	5.5	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass

* Boiling points and boiling point ranges, although not required, are provided for informational purposes.
** Since R11, R13, and R123 have normal boiling points at or above room temperature, non-condensable determinations are not required for these refrigerants.
*** Recognized chloride level for pass/fail is 3 ppm.

TABLE 1B.—PHYSICAL PROPERTIES OF ZEOTROPIC BLENDS (400 SERIES REFRIGERANTS)

	Reporting units	Reference (sub-clause)	R401A	R401B	R402A	R402B	R404A	R405A	R406A	R407A	R407B
Characteristics*											
Refrigerant Components.			R22/152a/124	R22/152a/124	R125/290/22	125/290/22	R125/143a/134a	R22/152a/142b/C318.	R22/600a/142b	R32/125/134a	R32/125/134a.
Nominal Comp, weight %.			53/13/34	61/11/28	60/2/38	38/2/60	44/52/4	45/7/5.5/42.5	55/4/41	20/40/40	10/70/20.
Allowable Comp, weight %.			51–54/11.5–13.5/33–35.	59–63/9.5–11.5/27–29.	58–62/1–3/36–40	36–40/1–3/58–62	42–46/51–53/2–6	43–47/6–8/4.5–6.5/40.5–44.5.	53–57/3–5/40–42	19–21/38–42/38–42.	9–11/68–72/18–22.
Boiling Point*	°F @ 1.00 atm		−27.7 to −18.1	−30.4 to −21.2	−54.8 to −53.9	−53.3 to −49.0	−51.0 to −49.8	−31.8 to −21.8	−32.7 to −15.0	−49.9 to −38.1	−53.1 to −45.2.
	°C @ 1.00 atm		−33.2 to −27.8	−34.7 to −29.6	−48.2 to −47.7	−47.4 to −45.0	−46.1 to −45.4	−34.0 to −21.9	−36.0 to −26.1	−45.5 to −38.9	−47.3 to −42.9.
Boiling Point Range*.	K		5.4	5.1	0.5	2.4	0.7	12.1	9.9	6.6	4.4.
Vapor Phase Contaminants:											
Air and other non-condensables.	% by volume @ 25°C.	5.9	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5.
Liquid Phase Contaminants:											
Water	ppm by weight	5.4	10	10	10	10	10	10	10	10	10.
All other impurities including refrigerants.	% by weight	5.1	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50.
High boiling residue.	% by volume	5.7	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01.
Particulates/solids	Visually clean to pass.	5.8	pass	pass	pass	pass	pass	pass	pass	pass	pass.
Acidity	ppm by weight	5.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0.
Chlorides**	No visible turbidity	5.5	pass	pass	pass	pass	pass	pass	pass	pass	pass.

* Boiling points and boiling point ranges, although not required, are provided for informational purposes.
** Recognized chloride level for pass/fail is 3ppm.
Shaded columns denote refrigerants for which analytical data is not available.

TABLE 1B (CONTINUED).—PHYSICAL PROPERTIES OF ZEOTROPIC BLENDS (400 SERIES REFRIGERANTS)

	Reporting units	Reference (subclause)	R407C	R408A	R409A	R410A	R410B	R411A	R411B	R412A
Characteristics:*										
Refrigerant Components.			R32/125/134a	R125/143a/22	R22/124/142b	R32/125	R32/125	R1270/22/152a	R1270/22/152a	R22/218/142.
Nominal Comp, weight %.			23/25/52	7/46/47	60/25/15	50/50	45/55	1.5/87.5/11.0	3/94/3	70/5/25.
Allowable Comp, weight %.			22–24/23–27/50–54	5–9/45–47/45–49	58–62/23–27/14–16	48.5–50.5/49.4–51.5	44–46/54–56	0.5–1.5/87.5–89.5/10–11.	2–3/94–96/2–3	68–72/3–7/24–26.
Boiling Point	°F@1.00 atm		46.4 to –33.0	−48.8 to −47.9	32.4 to −18.2	−60.1 to −60.0	−60.3 to −60.2			−40.2 to 25.6.
	°C@1.00 atm		−43.6 to −36.6	−44.9 to −44.4	−35.8 to −27.9	−51.2 to −51.1	−51.3 to −51.2			−40.1 to 32.0.
Boiling Point Range*	K		7.0	0.5	7.9	0.1	0.1			8.1
Vapor Phase Contaminants:										
Air and other noncondensables.	% by volume @25°C	5.9	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Liquid Phase Contaminants:										
Water	ppm by weight	5.4	10	10	10	10	10	10	10	10
All other impurities including refrigerants.	% by weight	5.1	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
High boiling residue	% by volume	5.7	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Particulates/solids	Visually clean to pass.	5.8	pass	pass	pass	pass	pass	pass	pass	pass
Acidity	ppm by weight	5.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chlorides**	No visible turbidity	5.5	pass	pass	pass	pass	pass	pass	pass	pass

*Boiling points and boiling point ranges, although not required, are provided for informational purposes.
**Recognized chloride level for pass/fail is 3ppm.
Shaded columns denote refrigerants for which analytical data is not available.

TABLE 1C.—PHYSICAL PROPERTIES OF AZEOTROPIC BLENDS (500 SERIES REFRIGERANTS)

	Reporting units	Reference (subclause)	R500	R502	R503	R507	R508	R509
Characteristics:*								
Refrigerant Components			R12/152a	R22/115	R23/13	R125/143a	R23/116	R22/218.
Nominal Comp. weight %.			73.8/26.2	48.8/51.2	40.1/59.9	50/50	39/61	44/56.
Allowable Comp. weight %.			72.8–74.8/25.2–27.2	44.8–52.8/47.2–55.2	39–41/59.61	49–51/49–51	37–41/59–63	42–46/56-60.
Boiling Point*	°F@1.00 atm		−28.1	−49.7	−127.7	−52.1	−123.5	−53.9.
	°C@1.00 atm		−33.4	−45.4	−88.7	−46.7	−86.4	−47.7.
Boiling Point Range*	K		0.5	0.5	0.5	0.5	0.5	0.5.
Vapor Phase Contaminants:								
Air and other noncondensables.	% by volume @25° C	5.9	1.5	1.5	1.5	1.5	1.5	1.5.
Liquid Phase Contaminants:								
Water	ppm by weight	5.4	10	10	10	10	10	10.
All other impurities including refrigerants.	% by weight	5.1	0.50	0.50	0.50	0.50	0.50	0.50.
High boiling residue	% by volume	5.7	0.05	0.01	0.01	0.01	0.01	0.01.
Particulates/solids	Visually clean to pass	5.8	Pass	Pass	Pass	Pass	Pass	Pass
Acidity	ppm by weight	5.6	1.0	1.0	1.0	1.0	1.0	1.0
Chlorides**	No visible turbidity	5.5	Pass	Pass	Pass	Pass	Pass	Pass.

*Boiling points and boiling point ranges, although not required, are provided for informational purposes.
**Recognized chloride level for pass/fail in 3ppm.

Appendix A. References—Normative

Listed here are all standards, handbooks, and other publications essential to the formation and implementation of the standard. All references in this appendix are considered as part of this standard.

ASHRAE Terminology of Heating, Ventilating, Air Conditioning and Refrigeration, American Society of Heating Refrigeration and Air-Conditioning Engineers, 1992, 1791 Tullie Circle N.E., Atlanta, GA 30329–2305; U.S.A.

ASHRAE Standard 34–1992, Number Designation and Safety Classification of Refrigerants, American Society of Heating Refrigeration and Air-Conditioning Engineers, 1992, 1791 Tullie Circle N.E., Atlanta, GA 30329–2305; U.S.A.

Appendix C to ARI Standard 700–95: Analytical Procedures to ARI Standard 700–95, Specifications for Fluorocarbon and Other Refrigerants, Air-Conditioning and Refrigeration Institute, 1995, 4301 North Fairfax Drive, Suite 425, Arlington, VA 22203; U.S.A.

Federal Specification for Fluorocarbon Refrigerants, BB–F–1421–B, dated March 5, 1992, Office of the Federal Register, National Archives and Records Administration, 1992, 800 North Capitol Street, N.W., Washington, D.C. 20402; U.S.A.

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