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United States Government Department of Energy

memorandum

DATE AUG 12 1994

REPLY TO
ATTN OF: Office of Environmental Guidance:Koss:67964

SUBJECT: RECOMMENDED APPROACHES TO MANAGEMENT OF REFRIGERANTS AT DOE FACILITIES

TO: Distribution

Environmental regulations and requirements, the production phaseout of ozone-depleting refrigerants, and the Department of Energy's (DOE) policy on ozone-depleting substances have a substantial effect on the management of refrigerants for refrigeration and air conditioning applications at the Department's facilities. The attached Office of Environmental Guidance (EH-23) document, "Recommended Approaches to Management of Refrigerants at DOE Facilities", was prepared to assist DOE and DOE contractor personnel in identifying and implementing both near-term actions and long-range strategies for refrigerant fluorocarbon management and phaseout.

The report is organized around a life-cycle costing approach based on the remaining useful life of existing refrigeration and air conditioning equipment, but which also considers other relevant factors (including energy efficiency, replacement and operational costs, type of application, capacity, facility mission and location, and available sources of refrigerant and alternatives) that need to be accounted for in refrigerant management decisions. The approaches discussed in this document should be sufficiently flexible to allow DOE managers to develop refrigerant management plans tailored to their individual needs, while fostering general consistency of these plans on a Department-wide basis.

In response to comments received from program and field offices on the November 1993, draft report, "Refrigerant Management Plan for Department of Energy Facilities", EH-23 has added new sections to this document dealing with class II ozone-depleting refrigerants, motor vehicle air conditioners, and building decommissioning, among other changes. EH-23 believes that input received from program and field elements and incorporated into the final report has contributed markedly to improving its usefulness.

These recommended refrigerant management approaches complement other DOE Headquarters activities related to the phaseout of chlorofluorocarbon (CFC)-based equipment. For instance, DOE's In-house Energy Management (IHEM) Program is a potential funding source for projects that decrease energy consumption and increase energy efficiency in DOE facilities and operations, including projects that replace existing CFC-based equipment with new, high-efficiency, CFC-free equipment. IHEM is supportive of providing assistance in this area and is willing to provide a guarantee of matching funds for these projects. Victor Petrolati, IHEM Program Manager, can be contacted for further information (202-586-4549). Also, the Office of Construction and Capital Projects (DP-32) has initiated the "Chlorofluorocarbons (CFC) HVAC-Chiller Retrofit Program " to provide a consistent prioritization method for the application of limited capital resources to address the replacement or conversion of CFC-based equipment in facilities of the Office of Defense Programs.

EH-23 requests that the attached report be widely distributed to DOE managers with oversight over building, operations and maintenance activities, and DOE contractors involved in refrigerant equipment purchasing, maintenance and operations, as well as to environmental personnel. EH-23 also solicits your input and viewpoints concerning the identification of other areas related to ozone-depleting substances for which our technical assistance may be of value to you. Ted Koss of my staff (202-586-7964) is our contact for ozone-depleting substance issues.

Raymond F. Pelletier
Director
Office of Environmental Guidance

Attachment

Recommended Approaches to Management of Refrigerants at Department of Energy Facilities

U.S. Department of Energy
Office of Environmental Guidance, EH-23
August 1994

ACKNOWLEDGEMENTS

This report was developed by the Department of Energy's (DOE) Office of Environmental Guidance (EH-23) with technical assistance from Pacific Northwest Laboratory (PNL)[1]. Contributors include Marjut Turner, Katharine Miller, Jennifer Matchett and Charles Purcell of PNL. Theodore Koss of EH-23 was the DOE technical manager. EH-23 wishes to recognize the valuable input and comments on the draft report provided by DOE program and field offices.

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ACRONYMS

ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEMP	Federal Energy Management Program
FR	Federal Register
GSA	General Services Administration
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HVAC	Heating, Ventilating, and Air Conditioning
IHEM	In-house Energy Management
MVAC	Motor Vehicle Air Conditioner
OSHA	Occupational Health and Safety Administration
SAE	Society of Automotive Engineers
SNAP	Significant New Alternatives Policy
TRADOC	U.S. Army Training and Doctrine Command
UL	Underwriters Laboratory

CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

Refrigeration and air conditioning[1] applications constitute a major area in which the U.S. Department of Energy (DOE) uses ozone-depleting substances. As the chlorofluorocarbon (CFC) production phaseout nears, these chemicals will become increasingly expensive and difficult to obtain. DOE facilities are in the process of preparing site-specific plans for transitioning out of ozone-depleting substance use. These efforts are being supported through the development of general guidance and policies that the facilities can incorporate into their individual management plans. One of the planning tools developed by the Office of Environment, Safety and Health to support facility phaseout efforts is the "Recommended Approaches to Management of Refrigerants at Department of Energy Facilities."

As a user, rather than a producer of ozone-depleting substances, DOE is not required to stop using CFCs by the December 31, 1995, production phaseout date. However, the fact that these substances will no longer be produced after 1995 argues for development and implementation of plans to switch to alternative chemicals and technologies. In addition, there are components of the Clean Air Act which users of ozone-depleting substances must comply with. These include Section 608 ("National Recycling and Emission Reduction Program"), which requires recovery and recycling of ozone-depleting refrigerants and prohibits deliberate venting of refrigerants during equipment servicing; Section 609 ("Servicing of Motor Vehicle Air Conditioners"), which requires that servicing of motor vehicle air conditioners (MVACs) be performed by certified technicians using approved recovery and recycling equipment; and Section 612 ("Safe Alternatives"), which requires ozone-depleting substance users to replace CFCs and halons only with EPA-approved alternative chemicals and processes.

Federal agencies must also meet the Federal procurement requirements of Section 613 of the Clean Air Act. Section 613 requires Federal agencies, including DOE, to conform their procurement regulations to the policies and requirements of Title VI and to maximize the substitution of safe alternatives for class I and class II substances. The final rule implementing this section does not require the immediate removal of existing equipment that uses ozone-depleting substances. However, "to the extent that the maintenance of such equipment requires the purchase of replacement CFCs, it would be affected by this rule, and agencies should adopt policies that maximize substitution of safe alternatives to ozone-depleting substances" (58 FR 54897).

Additional Federal procurement requirements are established by Executive Order 12843 ("Procurement Requirements and Policies for Federal Agencies for Ozone-Depleting Substances"), published in the Federal Register on April 23, 1993 (58 FR 21881). This order establishes as a policy of the Federal government that "Federal agencies implement cost-effective programs to minimize the procurement of materials and substances that contribute to the depletion of the stratospheric ozone, and give preference to the procurement of alternative chemicals, products and manufacturing processes that reduce overall risk to

[1] For the purposes of this report, refrigeration and air conditioning applications include household air conditioners and refrigerators, commercial air conditioners and chillers, commercial refrigeration, industrial process refrigeration, refrigerated transport, and air conditioning in vehicles.

human health and the environment by lessening the depletion of ozone in the upper atmosphere." This order also includes requirements to reduce emissions and develop practices for recycling ozone-depleting substances.

On June 30, 1994, the Office of the Deputy Secretary for Environment distributed draft DOE policy, requirements and guidelines on the procurement and use of ozone-depleting substances, which implement Executive Order 12843 and the Section 613 regulations, to program and field offices, for review and comment.

DOE's goal is to phase out the use of ozone-depleting substances by implementing environmentally safe alternative substances and processes within a timeframe that is consistent with the requirements and spirit of Executive Order 12843 and Title VI of the Clean Air Act. In order to effectively plan for the phaseout of ozone-depleting substances in refrigeration and air conditioning applications, DOE facilities need to identify and prioritize their current applications and develop plans to replace or convert these uses. This document is intended to serve as a framework for the development of individual site refrigerant management plans.

2.0 PURPOSE

Refrigeration and air conditioning uses of CFCs present a challenge to DOE facilities because of the limited number of approved CFC-refrigerant alternatives currently available. The estimated costs associated with retrofitting or replacing refrigeration equipment are high, and there is some concern over whether sufficient production capacity exists to meet the demand for equipment and retrofits from all consumers. In addition, there is concern that DOE facilities and other users of CFC-refrigerants may have difficulty obtaining sufficient quantities of these chemicals to service existing needs. The U.S. Environmental Protection Agency (EPA) and industry experts expect that shortages of CFCs will cause some disruptions to users as early as 1996 (Gushee, 1993; The News, 1993d). Recent projections by DuPont estimate that by 1996, the CFC-11 shortfall will be approximately 1 to 3 million pounds, and the CFC-12 shortage will be up to 50 million pounds (The News, 1993d). The finite supply of CFCs will also become increasingly more expensive as supplies dwindle, and taxes, imposed under the 1989 Omnibus Budget Reconciliation Act, increase annually.

Enhanced maintenance programs, including the use of reduced emission purge devices, leak detection, repair practices, and more careful servicing, could reduce future needs for refrigerants. Long-range planning approaches, such as the one outlined in this document, can help identify where potential shortfalls of CFCs, CFC substitutes, and alternative equipment may occur and help minimize the impacts of required equipment retrofit or replacement.

Many DOE facilities have already begun identifying and prioritizing their current applications and developing plans to replace or convert equipment and processes. These plans must also include programs for managing current CFC supplies for servicing applications that will be retained to some point in the future. This document is intended to assist DOE and DOE contractor personnel involved in facility maintenance, environmental operations, environmental safety and health, and refrigeration equipment purchasing and maintenance. Its purpose is to

help identify the general issues that need to be addressed in developing CFC-refrigerant management and phaseout plans. This document is intended to provide sufficient flexibility for the facilities to tailor CFC management activities to their individual needs.

The approach outlined in this document is intended to assist DOE facilities in meeting the requirements of Executive Order 12843 and Title VI of the Clean Air Act. In addition, it should assist facilities in developing long-range plans that will minimize the impacts of the CFC phaseout. For this reason, the approach followed in this document encompasses environmental regulatory requirements, as well as suggested approaches for long-range planning, energy efficiency considerations, and overall refrigerant management.

3.0 ELEMENTS OF A REFRIGERANT MANAGEMENT PLAN

This document is organized around a life-cycle costing approach based on the equipment's remaining useful life. Equipment age is often used by equipment manufacturers and others as a basis for making retrofit or replacement decisions. The concept of equipment's remaining useful life takes into account operational environment factors that impact the longevity of equipment operation (both positively and negatively) in a way that the age of the equipment alone cannot. The life-cycle costing approach used in this document provides detail beyond equipment age, taking into account factors such as return on investment and energy efficiency that should be considered in prioritizing equipment for phaseout.

DOE facilities should recognize that no single criterion is all-encompassing for determining whether equipment should be replaced, retrofitted, or retained. The remaining useful life of equipment, the operational environment, and sound engineering judgement and experience must be included in any analysis. Energy efficiency, replacement and operational costs, type of application, capacity, facility mission and location, available sources of refrigerant and alternatives, and other factors, will also affect equipment management decisions. These issues are addressed in this document, and the appropriate managers will need to ascertain the weight given to each of them in determining an appropriate course of action.

Because of the many considerations that influence decisions about equipment replacement (including energy efficiency requirements, building codes, procurement requirements, etc.), it is useful to build a team of professionals with knowledge of each of the areas that must be considered. This will help ensure that equipment replacement decisions will reflect the requirements of other regulations and requirements.

3.1 Class II Ozone-Depleting Substances

Significant attention is being given to the issue of whether to use hydrochlorofluorocarbons (HCFCs) as interim alternatives to CFC-refrigerants. HCFCs are class II ozone-depleting chemicals, most of which are currently scheduled for production phaseout in 2030. In addition, HCFCs are currently the only commercially available alternatives for some CFC-refrigerant applications. HCFC equipment that is purchased today should have ample time to realize a return on investment before the production phaseout comes into effect. Under Executive Order 12843, Federal agencies are required to take the phaseout schedule for HCFCs into account when developing plans for phasing out ozone-depleting substance use.

Order DOE 6430.1A, General Design Criteria (April 6, 1989), currently states that purchases of new refrigeration equipment should be limited to systems that contain HCFC-22[2]. Some HCFCs are also listed as acceptable substitutes for CFC-refrigerants under EPA's Significant New Alternatives Policy (SNAP) program (See Appendix A). In fact, both EPA and the United Nations Environment Programme encourage the use of HCFCs where other less-environmentally-damaging substitutes are not commercially available, in order to stimulate the replacement of CFCs.

The approach outlined in this document encourages the inclusion of HCFC-refrigerants in refrigerant management planning activities and equipment inventories. This will ensure that adequate planning is provided for the eventual phaseout of these refrigerants. In addition, the regulations pertaining to CFC-refrigerant recycling, disposal, and emission reduction also apply to HCFC refrigerants. Therefore, this document suggests that DOE facilities include these compounds in their refrigerant management planning activities.

4.0 FRAMEWORK FOR HVAC REFRIGERANT MANAGEMENT

4.1 Inventory Existing Equipment

An equipment inventory should form the basis for any general refrigerant management plan, and decisions on whether equipment is to be retained, retrofitted, or replaced. All major pieces of equipment should be listed separately in the inventory. Smaller equipment (such as window air conditioners, water coolers, and ice machines) can be grouped together for the building in which they are located. In addition to the type, location, and age of equipment that uses CFC-refrigerants, the inventory should include information on the equipment's present condition and service history. The inventory will be useful not only for refrigerant management but also for equipment repair and maintenance.

Each building should be inventoried separately. During the inventory, cooling requirements for the building should be reviewed, and an assessment made of whether existing equipment meets or exceeds that need. Information on future uses of the building, projected need for the building, and the activities that it houses should also be assessed along with any energy efficiency improvements that might reduce the need for cooling. This information will be useful in identifying the type and capacity of replacement equipment, if required, and the necessary useful life of the application. For example, extensive relighting may change the building cooling requirements. Individual building inventories will eventually be consolidated to develop long-range plans for the facility as a whole.

A sample equipment inventory sheet is provided in Figure 1. This sheet outlines the type of information that can be included in the equipment inventory. It is divided into three portions: general information, leak assessment rating, and refrigerant use. The equipment inventory should be updated as frequently as necessary to ensure that it continues to reflect the

[2] The section of Order DOE 6430.1A that deals with refrigeration and air conditioning equipment is undergoing revision. The draft, revised section would allow use of all other HCFCs designated as safe alternatives by EPA.

Figure 1

SAMPLE EQUIPMENT INVENTORY

Building(s) _____

General Information						Leak Assessment Rating					Refrigerant in Pounds								
Location, Model, and Serial #	Age (yrs)	Manufacturer	Warranty? (Y/N)	Type (ABR)	Capacity (tons)	Age	Piping	Purge	History	**TOTAL**	CFC-11	CFC-12	CFC-113	CFC-114	CFC-116	CFC-500	CFC-502	CFC-503	HCFC-22

TOTAL IN SYSTEM	CFC-11	CFC-12	CFC-113	CFC-114	CFC-116	CFC-500	CFC-502	CFC-503	HCFC-22

changing status of the equipment listed, and provides an up-to-date listing of equipment by building. This will facilitate long-range plans for phasing out CFCs, and help prepare the facility for the eventual phaseout of HCFCs.

4.1.1 General Information This portion of the inventory sheet includes information on the type of equipment, its age, and any warranties. This section also includes the name and telephone number of the equipment manufacturer, the size or capacity of the equipment in tons[3], and the model and serial numbers. Many of the major equipment manufacturers can provide assistance in equipment retrofit, conversion, and replacement. In general, the manufacturer, or the company that holds the service warranty, will be the first point of contact for this type of assistance. For larger facilities, it may also be beneficial to include the name of the contractor that manages the building in which the equipment is located.

Location of the equipment is an important consideration in decisions about retrofit or replacement. The cost of replacing equipment will increase if replacement requires major structural changes to the building (removal of walls, etc.). If the equipment is located in a hard-to-access area, the information recorded on the inventory sheet should include a note about the potential to locate the replacement equipment in a more accessible area.

4.1.2 Leak Assessment Rating The sample equipment inventory form contains a section that can be used to calculate a leak assessment rating. Under the Refrigerant Recycling regulations, EPA has established requirements for the retirement, repair, or retrofit of equipment that does not comply with the EPA standards. For commercial and industrial process refrigeration equipment with charges of 50 pounds or more, the maximum allowable leak rate is 35 percent per year. Most other appliances must comply with the lower allowable leak rate of 15 percent, but the applicability of this standard should be checked for each piece of equipment. The U.S. Army Training and Doctrine Command (TRADOC) (Army, 1992) recommends in its refrigerant management plan that each piece of equipment be rated according to its potential for leakage using the following criteria:

(1) the age and general condition of the equipment;

(2) the extent of the piping (the more extensive the piping and the more components in the system, the higher the probability of a leak);

(3) type(s) of purge units (i.e., older "automatic" style units that should be rated at a higher leak rating because of their higher refrigerant emissions compared with newer high efficiency purgers); and

(4) maintenance history (i.e., whether leakage been a problem in the past).

The leak assessment provides important information to be considered in determining the priority for equipment replacement or retrofit. For each of the criteria above, each piece of

[3] This document presents numerical criteria using the English measurement system to be consistent with most HVAC equipment specifications and EPA rulemakings dealing with stratospheric ozone protection.

equipment can be rated on a scale of 1-10 (with 10 being the highest leak rating). Adding the ratings for all criteria will result in an overall leak assessment rating for each piece of equipment. Use of this information to determine priority for equipment replacement or retrofit should be established by the DOE or DOE contractor personnel responsible for equipment management.

4.1.3 Refrigerant Use The sample inventory sheet in Figure 1 lists the class I refrigerants that are scheduled for production phaseout under Title VI of the Clean Air Act. DOE facilities should also collect information on equipment that uses other types of refrigerants to provide a reference for phaseout options and equipment procurement. The total amount of refrigerant in systems for each building can be combined with information from other buildings into the sample Refrigerant Inventory Form (Figure 2). The information collected on this sheet for each piece of equipment in the building can also form the basis for determining the quantity of refrigerant in systems that is potentially available for recovery, recycle, and reuse.

4.2 Decision Making

Once the inventory has been completed, the equipment can be classified according to its remaining useful life and, within this grouping, according to its function and its leak assessment rating. This document has established three categories of remaining useful life as decision points for refrigerant management: greater than 10 years, 5 to 10 years, and less than 5 years of remaining useful life. The engineers in charge of equipment maintenance and service will generally be responsible for determining the equipment's remaining useful life; however, it is recommended that the useful life of the equipment not be excessively prolonged. Facilities may tend to retain equipment until the cost of maintenance exceeds or approaches the cost of replacement. The fact that CFCs will become increasingly difficult and expensive to obtain should be factored into determinations of the equipment's remaining useful life. Figure 3 provides a framework for decision making based on equipment remaining useful life.

As mentioned earlier, the age of equipment alone is generally not a sufficient basis for making determinations on replacement. All of the information collected in the inventory, as well as information on the condition of other parts of the system, should be evaluated when making replacement decisions. If, for example, the chiller is in fair condition but the cooling tower requires repair, it may be worthwhile (in terms of downtime) to combine the cooling tower repair with the chiller retrofit or replacement. These decisions will need to be made on a case-by-case basis through an evaluation of the individual system.

4.2.1 Less Than 5 Years Remaining Useful Life Equipment with a remaining useful life of less than 5 years has generally the highest priority for replacement. In general, this equipment is less cost-effective to retrofit than newer equipment and tends to be more prone to leakage. Facilities should examine the information in the inventory for all equipment in this age category. If the equipment has a poor service history, high leak assessment score, and high level of refrigerant use, it should be put on the priority list for replacement. A decision to buy new equipment may be cost-effective.

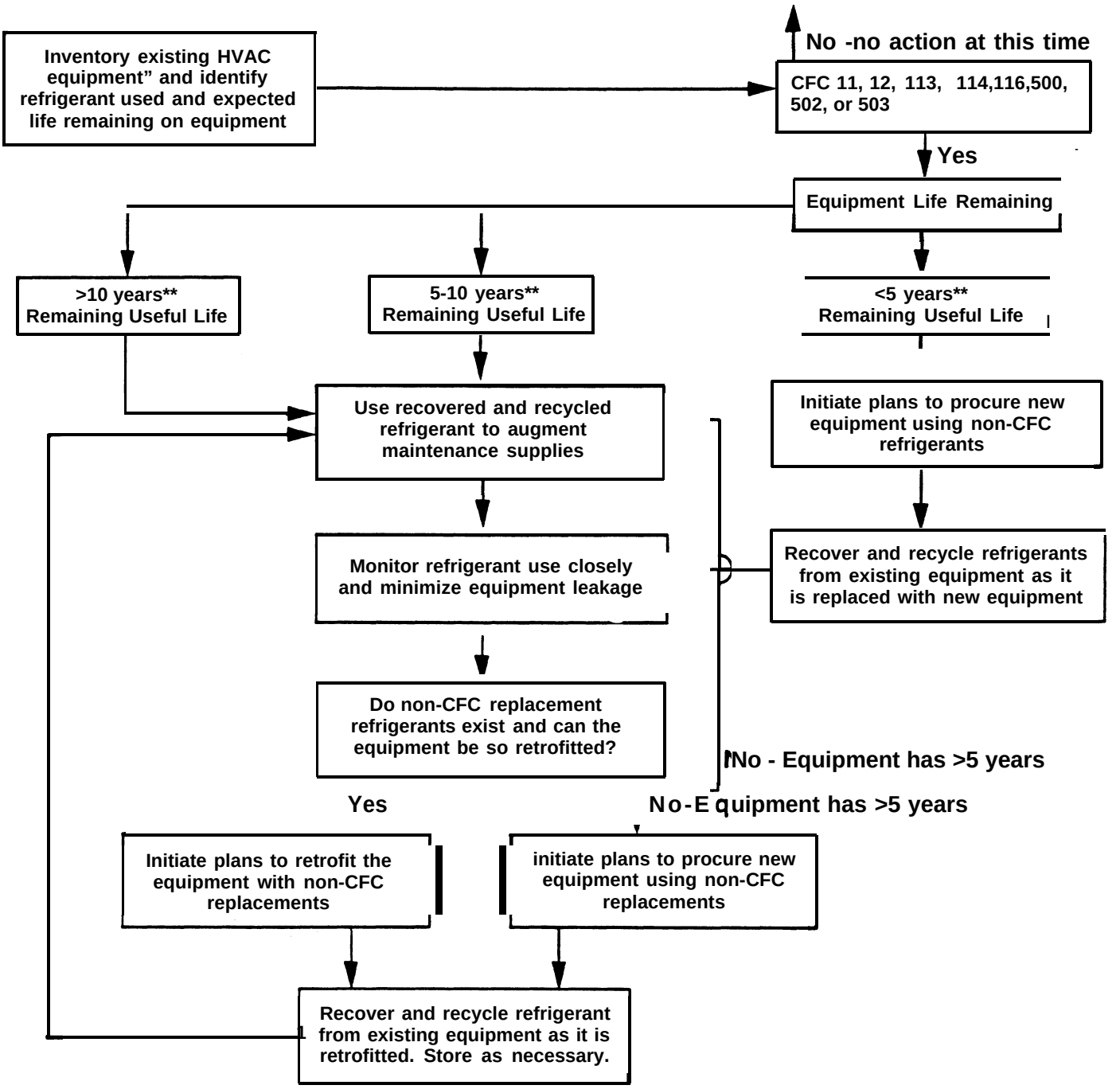
SAMPLE REFRIGERANT INVENTORY

Building	Pounds In System									Pounds In Storage								
	CFC-11	CFC-12	CFC-113	CFC-114	CFC-116	CFC-500	CFC-502	CFC-503	HCFC-22	CFC-11	CFC-12	CFC-113	CFC-114	CFC-116	CFC-500	CFC-502	CFC-503	HCFC-22

TOTAL	Pounds In System									Pounds In Storage								
(sum columns)	CFC-11	CFC-12	CFC-113	CFC-114	CFC-116	CFC-500	CFC-502	CFC-503	HCFC-22	CFC-11	CFC-12	CFC-113	CFC-114	CFC-116	CFC-500	CFC-502	CFC-503	HCFC-22

Figure 3

SUGGESTED APPROACH FOR HVAC REFRIGERANT MANAGEMENT



- The equipment inventory and use of this document should lead to a plan that determines what actions (rnaintenance, retrofit. or replacement) should be taken for each existing piece of equipmenL This Inventory should be done by building and then by facility.

•• It is recognized that age of equipment is not the only criterion for deciding a particular strategy. Energy efflclency, cost, size, location, available sources of refrigerant, and other factors will also Impact the classlflcatlon of equipment, A methodology to assess these factors and plan for a reasonable uniform declslon on when a particular piece of equipment Is a candidate for replacement, reclamation to "bridge the gap, " or retroflttlng to use non-CFCs wlll need to be developed.

4.2.2 5-10 Years Remaining Useful Life Unlike equipment that is nearing the end of its useful life, equipment in the 5-10 year remaining useful life category may be cost-effectively retrofitted or maintained. Again, examining the other information contained in the inventory is necessary, including the equipment's service history, the leak assessment rating, and the equipment's energy efficiency. If the equipment is in the newer end of the 5-10 year remaining useful life range and is in generally good condition, replacing it prior to its end of useful life may not be necessary. If the equipment is older, or is in generally poor condition, it should be added to the list of equipment to be retrofitted or replaced in the near future.

4.2.3 10 or More Years Remaining Useful Life In general, it is probably not reasonable nor cost-effective to replace or extensively retrofit equipment with 10 or more years of remaining useful life. This equipment is likely to be in fairly good condition, and it will probably be economically impractical to replace. In addition to considering the other information collected on this equipment in the inventory, planners must also assess the amount and type of refrigerant required to maintain this equipment. Long-range planning should include an assessment of the amount and type of CFCs required for equipment maintenance, as well as plans for securing these chemicals now and in the future. It may be possible to service the equipment by using CFCs that are recovered and recycled from equipment that is replaced.

DOE managers also need to be aware of energy efficiency requirements for Federal buildings established under the Federal Energy Management Program (FEMP). The goals of FEMP are to reduce Federal energy consumption and to promote life cycle, cost-effective investments in building energy systems (10 CFR Part 436). Executive Order 12902, "Energy Efficiency and Water Conservation at Federal Facilities," (59 FR 11463, March 10, 1994) requires each Federal agency to develop and implement a program with the intent of reducing energy consumption by 30% by the year 2005 measured relative to the agency's 1985 energy use.

Replacement of existing HVAC equipment with newer, more efficient equipment can assist facilities in meeting the goals of FEMP. The DOE In-house Energy Management (IHEM) Program can assist facilities in meeting the energy efficiency requirements of the Executive Order 12902. IHEM is providing funding for certain viable energy projects, which may include replacement of existing CFC chillers with new, high-efficiency CFC-free chillers. It is recommended that someone with a thorough knowledge of the required life-cycle cost calculation requirements be designated as part of the team that is examining refrigeration and air conditioning equipment replacement.

Until the new equipment is purchased, all equipment should be maintained properly, which includes preventive maintenance and minimization of leaks. When new equipment is purchased, the old refrigerant should be recovered and reclaimed for servicing existing equipment or for transfer to other DOE facilities that require it.

5.0 REFRIGERANT MONITORING AND MANAGEMENT

The refrigeration and air conditioning equipment used in DOE facilities is similar to that found in private industry and is susceptible to the same operational and maintenance problems. These include piping and fitting leakage, seal failures, refrigerant losses through air purge systems, and refrigerant losses during recovery and recycling of refrigerant. Whether

equipment is scheduled for retrofit or replacement, or is going to be retained, DOE facilities need to ensure that refrigerant losses and leaks are minimized. Table 1 outlines recommended activities for refrigerant monitoring and management.

TABLE 1 - List of Recommended Refrigerant Monitoring and Management Activities

Document refrigerant usage
1. Include oil usage in centrifugal systems

Train operations personnel in refrigerant awareness/management
1. No Venting Rule (CAA Title VI, Section 608)
2. Lowest achievable emissions
3. Procurement limitations

Ensure Material Safety Data Sheet (MSDS) documentation
1. Amount purchased per year, etc.
2. New versus recycled

Install mechanical room monitors
1. Refrigerant detection monitor
2. Oxygen-deprivation sensor

Install refrigerant system monitors
1. Moisture detection monitor
2. Lubricating oil contaminants detection system

Upgrade mechanical room ventilation to meet ASHRAE Standard 15-1992, "Safety Code for Mechanical Refrigeration"

As CFCs become more expensive as a result of excise taxes and scarcity, it is in the interest of DOE facilities to minimize the amount of refrigerant lost to the environment. In addition, the procurement policy established by Executive Order 12843 requires Federal agencies to implement practices that reduce emissions of ozone-depleting substances. The EPA currently requires that "Owners of commercial refrigeration and industrial process refrigeration equipment must have all leaks repaired if the equipment is leaking at a rate such that the loss of refrigerant will exceed 35 percent of the total charge during a 12 month period," unless "...within 30 days, the owner develops a one-year retrofit or retirement plan for the leaking equipment" (58 FR 28716). Most other equipment is subject to these same requirements if its leak rate exceeds 15 percent of the total charge during a 12 month period. In its final rule on refrigerant recycling (40 CFR Part 82, Subpart F), EPA stated its intent to develop comprehensive regulations to reduce refrigerant leakage during equipment use in the next phase of rulemaking under Section 608 of the Clean Air Act. Future regulations from EPA may include requirements for leak detection and repair, as well as efficiency requirements for purge devices (EPA, 1992).

Preventive maintenance and leak minimization play an integral role in extending the equipment's useful life. It is recommended that DOE facilities include regular maintenance checks and repairs in their refrigerant management plans. It may be possible to service equipment that will be retained using CFCs recovered from equipment that has been retrofitted or replaced. In addition, several activities can be undertaken to reduce the amount of refrigerant required during equipment servicing. These include use of leak detection devices and, for low pressure systems, the use of high efficiency purge units. The American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) has published guidelines for minimizing refrigerant leakage. Copies of "Reducing Emission of Fully Halogenated Chlorofluorocarbon (CFC) Refrigerants in Refrigeration and Air-Conditioning Equipment and Applications" (ASHRAE Guideline 3-1990) can be obtained from ASHRAE for $22 at the following location:

ASHRAE
1791 Tulle Circle, NE
Atlanta, GA 30329
Phone: (404) 636-8400

This ASHRAE guideline identifies possible sources of refrigerant loss in air conditioning and refrigeration systems, and discusses installation and servicing practices that can minimize these losses.

5.1 Refrigerant Leak Testing

All equipment should be inspected for signs of leakage. The equipment service history information and leak assessment score collected during the equipment inventory can help to identify equipment that may have a significant leakage problem. When an undercharge in the refrigerant level of a piece of equipment is found, the equipment should be thoroughly inspected for leaks prior to recharging. Technicians should look for signs of leaking refrigerant oil, as this generally indicates the potential for leaking refrigerant. Leak testing should be done when routine maintenance is performed and whenever recharge is required. Several types of leak detection equipment are available. If the refrigeration and air conditioning equipment is under warranty, the company carrying the warranty will generally be charged with investigating and repairing leaks. In centrifugal compressors, the apparent undercharge may indicate oil contamination of the refrigerant (The News, 1993a).

If the system is a low pressure system and the equipment is regularly losing refrigerant through air purges, it is recommended that the equipment be upgraded with high efficiency purge units which are generally available from the equipment manufacturers. Whether to upgrade will depend on the rate of leakage and how long the equipment will remain in use before being retrofitted with an alternative refrigerant or replaced.

5.2 Refrigerant Containment

Minor modifications can be made to equipment to ensure better refrigerant containment. These modifications include installation of high efficiency purge units, an on-line oil cleaning and filtering system, refrigerant access servicing and recovery apertures, refrigerant isolation valves, no/low leak mechanical shaft seals, low loss fittings for hoses in portable equipment,

and microprocessor-based controls and monitoring systems (GSA, 1993). Most of these retrofits are available from equipment manufacturers. Whether to implement these modifications will depend on the leak assessment score and the age of the equipment, as well as the efficiency of the equipment. For equipment that is scheduled for replacement in the near future, these modifications may not be cost-effective. For equipment that will be retained, however, such modifications can reduce refrigerant waste and decrease costs, as well as preserve limited refrigerant supplies.

5.3 Technician Training and Certification

Effective November 14, 1994, 40 CFR Part 82, Subpart F will require anyone performing service on refrigeration or air conditioning equipment to be certified under an EPA-approved program. Without certification, technicians will not be able to install, service, maintain, or repair systems if such work has the potential to release refrigerants. These regulations also require that refrigerant be recovered from the system and reused, rather than being released to the atmosphere, and they restrict the sale of virgin CFCs to certified technicians. EPA's current listing of approved Subpart F technician certification programs is provided as Appendix B.[4] The requirements for approved recycling equipment and technician certification for motor vehicle air conditioners (MVACs) were effective August 13, 1992.

Several companies, including equipment manufacturers, provide recovery equipment and services. Depending on the amount of equipment at a DOE facility, it may be cost-effective to contract this servicing out. For equipment that is under a service warranty, technician training and recovery equipment purchase become the responsibility of the company holding the warranty. However, it is important to ensure that technicians from such companies are properly certified. 40 CFR Part 82, Subpart F also links technician certification with the ability to purchase refrigerants or to work on systems where refrigerant recovery and recycling is required. If recovery and recycling are to be performed on-site, the facility will need to purchase equipment that has been certified or listed by the Air Conditioning and Refrigeration Institute (ARI) or Underwriters Laboratories (UL).

6.0 RECYCLING AND RECOVERY

Section 608 of the Clean Air Act establishes requirements for recovery and recycling of refrigerants from stationary sources. The EPA issued a final rule implementing Section 608 (40 CFR Part 82, Subpart F) on May 14, 1993. This regulation prohibits the resale of recycled refrigerants (that have not been reclaimed) for two years to give industry sufficient time to develop purity guidelines. Recovery and recycling of CFCs during equipment service to prevent venting to the atmosphere is required by law and will be necessary to ensure cost-effective operation during the time the equipment is kept in service.

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[4] Updates of EPA's lists of approved Subpart F and Subpart B certification programs, as well as other useful information related to ozone-depleting refrigerants, can be obtained from EPA's Stratospheric Ozone Information Hotline at (800) 296-1996.

Recycling technologies for many large-scale applications of CFC-12 and CFC-502 refrigerants have existed for many years and may be usable on current equipment. Recycling and recovery services can be provided by off-site contractors, or equipment can be purchased for on-site processing. The capacity of the refrigeration equipment may be a determining factor for the type of recycling service to use. Systems with large refrigerant charges may be more efficiently recycled using off-site services. In addition to recovery/recycling equipment, facilities may also need to purchase cylinders to contain the refrigerant that is recovered. Personnel will also need to ensure that they are complying with any applicable refrigerant storage area requirements.

The recycling process, which involves cleaning of the refrigerants, can be accomplished in many different ways. The system can be single-pass, multi-pass or single-pass with a multi-pass option. A single-pass system cleans the refrigerant while the halocarbon is being recovered. A multi-pass system cleans the refrigerant to a specified level by allowing the substance to continue to pass through the recycling system. The more the substance is passed through the recycling system, the cleaner the end product will be. A single-pass system has a recycling rate that is equal to the recovery rate, which is determined by temperature, pressure, and volume.

In some cases, refrigerant that is recovered from systems will need to be reclaimed. Reclamation is generally performed off-site and is a chemical process that removes impurities from the refrigerant. Under 40 CFR Part 82 Subpart F, only reclaimed refrigerant (that is refrigerant that has been certified to meet the ARI-700 standard for purity) can be transferred between equipment owners. EPA has indicated that DOD may transfer refrigerant between equipment at different DOD facilities, so long as the equipment and refrigerant are owned by DOD. If EPA applies a consistent approach, DOE facilities should not have to provide certification for refrigerants transferred between DOE facilities. Some recycling systems are capable of meeting the requirements for reclaimed refrigerant; however, the refrigerant must still be tested to ensure that this standard has been attained prior to being sold to another user. One advantage to using a reclamation service for recovery and recycling of refrigerants is that the reclamation company undertakes the responsibility to dispose of the refrigerant contaminants, which may be considered hazardous waste.

Refrigerant manufacturers have established programs for returning used (non-recycled or non-reclaimed) refrigerant through their wholesale distribution network in return for credits, and many reclamation centers will purchase used refrigerants. Prior to taking advantage of these services, however, DOE facilities should assess the need for recovered refrigerants to extend the useful life of equipment that will be retained. Under the requirements of 40 CFR Part 82, Subpart F, EPA has established minimum requirements for recycling and recovery equipment. These requirements are listed in Tables 2 and 3.

TABLE 2 -- Levels of Evacuation Which Must be Achieved by Recovery or Recycling Equipment Intended for Use with Appliances (Manufactured or Imported on or After November 15, 1993)

Type of appliance with which recovery or recycling machine is intended to be used	Inches of Hg vacuum
HCFC-22 appliances, or isolated component of such appliances, normally containing less than 200 pounds of refrigerant	0
HCFC-22 appliances, or isolated component of such appliances, normally containing 200 pounds or more of refrigerant	10
Very high-pressure appliances	0
Other high-pressure appliances, or isolated component of such appliances, normally containing less than 200 pounds of refrigerant	10
Other high-pressure appliances, or isolated component of such appliances, normally containing 200 pounds or more of refrigerant	15
Low-pressure appliances	*25

Except for small appliances, MVACs, and MVAC-like appliances
* mm Hg absolute

Such equipment manufactured before November 15, 1993, will be considered certified if capable of achieving the level of evacuation in Table 3 when tested using a properly calibrated pressure gauge.

TABLE 3 - Levels of Evacuation Which Must be Achieved by Recovery or Recycling Equipment Intended for Use with Appliances (Manufactured Before November 15, 1993)

Type of air-conditioning or refrigeration equipment with which recovery or recycling machine is intended to be used	Inches of vacuum (relative to standard atmospheric pressure of 29.9 inches Hg)
HCFC-22 equipment, or isolated component of such equipment, normally containing less than 200 pounds of refrigerant	0
HCFC-22 equipment, or isolated component of such equipment, normally containing 200 pounds or more of refrigerant	4
Very high-pressure equipment	0
Other high-pressure equipment, or isolated component of such equipment, normally containing less than 200 pounds of refrigerant	4
Other high-pressure equipment, or isolated component of such equipment, normally containing 200 pounds or more of refrigerant	4
Low-pressure equipment	25

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

Recovery and recycling of refrigerants is a key element in long-term refrigerant management. In the final rule (58 FR 54892) for Section 613 ("Federal Procurement") of the Clean Air Act, EPA recommended banking any refrigerant reclaimed from equipment that is being replaced or retrofitted as a method of reducing the amount of new material that must be purchased for use in equipment that will be retained. Unless the used refrigerant is severely contaminated (in which case it must be properly disposed of), recovery and recycling is a viable option for extending DOE refrigerant supplies. From information obtained in the equipment and refrigerant inventories, the facility should have information available on the amount(s) and type(s) of CFCs currently being used and the amount anticipated for meeting future needs. The facility may be able to procure anticipated CFC supplies and bank them against the need for servicing equipment in the future. In developing CFC refrigerant banks, facilities are encouraged to seek sources of recovered and recycled CFCs within the DOE complex (e.g., from another facility that anticipates an excess of these chemicals). DOE's draft requirements and guidelines on the procurement and use of ozone-depleting substances distributed by the Office of the Deputy Assistant Secretary for Environment on June 30, 1994, recommend that DOE facilities obtain supplies of class I refrigerants from onsite, recycled refrigerant, and from surplus stocks stored across the DOE complex, in order to minimize purchases of replacement class I refrigerants for existing equipment from outside sources. Several facilities

are currently storing halons and other ozone-depleting substances on-site pending decisions on disposal.[5] Table 4 lists activities recommended for recovery, recycling, and reclamation.

TABLE 4 - List of Recommended Recovery, Recycling, and Reclamation Activities

A. Ensure that all technicians handling refrigerants are properly trained and certified to perform the maintenance and recovery/recycling tasks

B. Install access ports for refrigerant recovery using low/no loss fittings

C. Install on-site refrigerant storage vessel or purchase/rent EPA/DOT-approved storage containers

D. Dispose of waste oil properly - use waste and removal contractors for proper disposal of hazardous materials (oil contaminated with refrigerant may constitute a hazardous waste in some locations)

E. Choose on-site or off-site refrigerant recycling based on DOE facility needs, personnel capabilities and system capacity

- Obtain a portable refrigerant recovery unit compatible with the installed systems which is of sufficient capacity to comply with regulations

- Contract out for recovery and reclamation of used refrigerant on a recurring basis or as needed

7.0 RETROFITTING

For equipment with more than 5 years of remaining useful life, it may be cost-effective to retrofit the equipment. There are currently no drop-in replacements for CFCs in existing refrigeration and air conditioning equipment. Retrofitting, therefore, usually requires replacement of other equipment components (such as seals) or can involve replacement of the entire drive line. Many manufacturers recommend that conversions be planned at the same time as the recommended major overhauls (The News, 1993c). This prevents costly, unscheduled shutdown of systems. Issues that should be considered when determining whether equipment should be retrofitted are the service history of the equipment, the leak assessment rating, and the potential future cost and availability of refrigerants for servicing

[5] The Office of the Assistant Secretary for Defense Programs has set up a halon repository at the Savannah River Site to receive excess halon from other facilities.

the equipment. Table 5 lists items that should be considered when planning equipment retrofits.

TABLE 5 - Equipment Retrofit Considerations

Life cycle costing:
- Remaining useful life/equipment size
- Service history
- Leak assessment score
- Facility refrigerant phaseout schedule
- Current refrigerant cost
- Availability of refrigerant supplies
- Operations and maintenance costs
- Equipment annual hours of operation
- Energy costs of current equipment versus retrofit
- Retrofit cost

Issues:
- Chiller performance/desired performance
- Projected building air conditioning growth (for HVAC)
- Safety requirements
- Power requirements (electricity, gas)

Facilities must also address provisions to maximize use of safe alternatives to CFCs as established in Executive Order 12483 and the Federal procurement requirements of 40 CFR Part 82, Subpart G. Both of these establish a policy to minimize the purchase of class I substances, give preference to the procurement of alternatives, and encourage recovery and recycling of existing class I substances. A draft policy statement, and a draft requirements and guidelines document, that implement these two directives, were issued for review and comment to program and field offices on June 30, 1994, by the Office of the Deputy Assistant Secretary for Environment. If the refrigerant inventory indicates that sufficient supplies of recycled or recovered refrigerant will not be available to service the equipment for the remainder of its useful life, serious consideration should be given to replacing or retrofitting the equipment in an appropriate timeframe.

The size of the equipment should also be considered when making a decision on retrofitting. The Army TRADOC recommends replacing, rather than retrofitting, small-scale equipment such as window air conditioners (Army, 1992). Retrofits for this equipment are generally not available or not cost-effective. For larger equipment, the energy efficiency of the existing equipment versus retrofitted or new equipment should be considered. For highly inefficient systems, replacing the system may be more cost-effective than retrofitting if the costs of replacement can be realized in energy savings. The decision whether or not to retrofit will be facilitated by a comparison of the equipment's current performance with desired performance. If the present system is barely meeting current needs, then retrofitting will not be likely to enhance performance enough to justify it. In any decision, DOE facilities should contact the original manufacturer for consultation. The manufacturer should be able to analyze the

current system and project the expected system performance after conversion to another refrigerant (Trane, 1991). Managers should investigate any impacts that a change of refrigerant may have on equipment warranties.

The equipment manufacturer should be able to provide information on available alternative refrigerants. Another source of information is *An Assessment of Alternatives and Technologies for Replacing Ozone-Depleting Substances at DOE Facilities* (PNL, 1992), which provides a description of several alternative refrigerants that are currently commercially available and under development. Many alternative refrigerants require changes to the equipment seals and electrical motors, as well as the compressors. These costs will also need to be factored in to the overall costs of retrofit. The timeline for retrofitting equipment should coincide with the goals for CFC refrigerant phaseout for the facility and the service schedule for the equipment.

8.0 NEW EQUIPMENT

Managers should plan to obtain new equipment that uses HCFCs or non-ozone-depleting substances if (1) the remaining useful life of the equipment is less than 5 years, (2) the service history and leak assessment indicate that replacement would be cost-effective, or (3) they believe that adequate supplies of refrigerant will not be available to service the equipment in the future. The equipment manufacturer or company that holds the warranty should be able to provide information and recommendations on new equipment. As with equipment retrofitting, several considerations are involved in determining the best replacement equipment. Table 6 lists items to be considered when deciding to replace old equipment.

Section 1565-1.1 of Order DOE 6430.1A, General Design Criteria (April 6, 1989), specifies that purchases of new refrigeration equipment should be limited to, and where feasible existing equipment should be replaced with, equipment using HCFC-22 (R-22). The purchase of new equipment using CFCs is prohibited. Order DOE 6430.1A is currently under revision, and the Office of Environment, Safety, and Health and the Office of Energy Research have provided input to the revision process that encourages consideration of other non-CFC refrigerants. Executive Order 12843 requires Federal agencies to minimize, where economically practicable, their purchases of class I substances. Executive Order 12843 also states that in developing their procurement policies, Federal agencies should be aware of the phaseout schedule for class II substances (HCFCs) as well.

If the equipment has a poor service history or is prone to leaks, replacement may be the most cost-effective option. In addition to current leak minimization requirements, EPA has stated that it is planning to develop standards for controlling refrigerant leaks that occur during normal equipment operation. The costs of repairing the equipment to meet EPA standards should be subtracted from the cost of equipment replacement when developing a life cycle cost analysis.

TABLE 6 - Equipment Replacement Considerations

Life cycle costing:

- Remaining useful life/equipment size
- Service history
- Leak assessment score/cost of leak repair
- Facility refrigerant phaseout schedule
- Current refrigerant cost
- Availability of existing refrigerant supplies
- Operations and maintenance costs
- Equipment annual hours of operation
- Energy costs of current equipment vs. replacement
- Cost of new equipment
- Construction cost - for new equipment
- Utility company rebate (if applicable)
- Availability of non-CFC refrigerants and equipment

Issues:

- Chiller performance/desired performance
- Projected building air conditioning growth (for HVAC)
- Safety requirements
- Power requirements (electricity, gas)

In addition to considering the remaining useful life of the equipment and the leak assessment rating, DOE facilities should take into account the energy efficiency of their existing equipment when compared with the efficiency of new equipment. If the equipment has less than 5 years of remaining useful life, greater energy efficiency can likely be achieved with new equipment. Equipment that was manufactured in the 1970's is significantly less energy efficient than equipment manufactured today. If information on the required level of cooling for individual buildings was collected at the time of inventory, this information should be reviewed to determine the possibility of replacing existing equipment with smaller, more efficient units. If significant energy efficiency increases are attainable, the return on investment in new equipment may occur within 3 years (The News, 1993c). 10 CFR Part 435 defines rules for energy efficiency minima for any new construction in Federal buildings. Until the new equipment is purchased, equipment should still be maintained properly, and when new equipment is purchased, the old refrigerant should be recovered and reclaimed for banking. (See Recycling and Recovery section.) The size of the equipment will also be an important factor in decisionmaking. In general, smaller equipment (such as window air conditioners) are more cost-effective to replace than retrofit.

Prior to identifying alternative refrigerants for use in new or retrofitted equipment, managers should determine the required level of personnel safety. DOE facilities should comply with appropriate Occupational Health and Safety Administration (OSHA) standards, as well as guidelines developed by ASHRAE and included in ASHRAE Standard 15-1992 ("Safety Code for Mechanical Refrigeration").

9.0 BUILDING DECOMMISSIONING

One of the criteria for determining whether equipment should be replaced or retrofitted is the future need for the equipment or the facility in which it is housed. If the facility is scheduled for decommissioning in the near future, it may not be cost-effective to retrofit or replace the HVAC equipment. Along with the other elements of the refrigerant equipment inventory, the mission requirements should also be considered. If a decision is made to retain the equipment because the facility will be decommissioned in the near future, plans should be developed to minimize leakage and to capture the CFCs for use in equipment or facilities that will be retained.

If the facility decommissioning is not imminent, the other components of the refrigerant equipment inventory will need to be evaluated to determine whether retrofit or replacement of the equipment will be cost-effective. One consideration may be the energy efficiency of the existing equipment versus the energy savings that may be obtained by replacing the equipment. In addition, the availability of CFC-refrigerants to service the equipment over the period during which it will be retained should be evaluated to determine whether sufficient supplies will be available to see the facility through to the end of its mission.

Some facilities that may be decommissioned in the near future could contain CFCs that have been radioactively contaminated, or been contaminated by other substances that render the CFCs unusable for other applications. Facilities will need to address these issues on a case-by-case basis, including making plans for safe disposal or destruction of these CFCs.

10.0 FRAMEWORK FOR MVAC REFRIGERANT MANAGEMENT

Although this document focuses on the refrigerants contained in stationary sources, use of ozone-depleting substances in mobile air conditioners, like other air conditioning and refrigeration equipment, is regulated under the Clean Air Act. Regulation of motor vehicle air conditioners (MVACs) and MVAC-like[6] recycling and recovery equipment is derived from Section 609 ("Servicing of Motor Vehicle Air Conditioners"), as well as Section 608 ("National Recycling and Emission Reduction Program"), of the Clean Air Act. Applicability of Clean Air Act regulatory requirements to air conditioners in motor vehicles (i.e., any vehicle which is self-propelled and designed for transporting persons or property on a street or highway), and other vehicles (e.g., airplanes, construction equipment) can be determined by reviewing the Section 609 implementing regulations (at 40 CFR Part 82 Subpart B) and the Section 608 regulations (at 40 CFR Part 82 Subpart F). These regulations apply to all class I and class II refrigerants used in MVAC or MVAC-like equipment.

Aggressive recycling, and leak detection and repair, as well as adherence to the guidelines of required evacuation for MVACs and MVAC-like appliances, are critical for minimizing the shortfall of CFC-12 expected after the production phaseout on December 31, 1995

[6] MVAC-like equipment is defined as mechanical vapor compression, open-drive compressor appliances using 2-3 pounds of CFC-12 to cool the driver's or passengers' compartment of a non-road vehicle, including agricultural and construction vehicles.

(The News 1993d). Like that of non-mobile air conditioner equipment, all repair or service of MVAC and MVAC-like equipment is regulated to ensure technician certification, use of appropriate refrigerant recycling equipment, and recordkeeping of approved refrigerant recycling equipment.

10.1 Inventory

If the facility operates a vehicle fleet, automobile air conditioners should be inventoried and listed separately from HVAC equipment. In the case of General Service Administration (GSA) vehicles, GSA should be contacted to determine DOE responsibility for refrigerant management of the vehicles.

10.2 Technician Training

The requirements for technician certification for MVACs were effective on August 13, 1992. Without certification, technicians may not purchase any class I or class II substances, nor service, or repair motor vehicle air conditioning systems. Any technicians involved in such activities must have been certified through an EPA-approved course. Technicians for other mobile MVAC-like equipment must be certified under either a Section 609 MVAC program or a program for high-pressure equipment (Type II) under Section 608. EPA's current listing of approved technician certification programs for MVACs is provided as Appendix C.

10.3 Recycling/Recovery

Given the increasing cost of CFC-12 as taxes and demand increase, refrigerant recycling is not only statutorily required but is a cost-effective procedure. Persons opening mobile air conditioners for maintenance, service, or repair may only do so if they "properly use" recycling or recovery equipment approved by EPA. The definition of "properly using" in 40 CFR Part 82.32(e) means recycling the refrigerant before it is reused. Intentional venting is an "improper use" of equipment.

Recycled refrigerant for MVACs or MVAC-like equipment may be reused if it is reclaimed to the EPA standards of purity set in the appendices of the rulemaking (Appendix A to 40 CFR Part 82, Subpart B), specifically, ARI-Standard 700-88 and Society of Automotive Engineers (SAE) Standards. Managers must certify that all recovery or recycling equipment for refrigerants in MVACs or MVAC-like appliances meets EPA standards as of August 13, 1992. In addition, MVAC-like appliances must have the system pressure reduced to 102 mm of mercury vacuum (4 inches under the SAE Standard (SAEJ1990)) for recovery.

Section 609 requires establishments repairing or servicing MVACs to certify to EPA that they have acquired and are properly operating approved equipment by trained and certified technicians. All records should be kept on-site for a minimum of three years.

10.4 Retrofitting

Nationally, complete recycling is expected to supply only 40 percent of the CFC-12 needed due to system leakage over time. DuPont estimates a shortfall of 20 to 50 million pounds of CFC-12 in 1996 (The News, 1993d). Thus, by 1996, equipment could become obsolete. No

chemical has been found which can directly replace CFC-12 as a "drop in" substitute. Instead, the system can be retrofitted to use an alternative refrigerant. The cost for a retrofit encompasses the cost to alter the system itself; specifically, the desiccant, the freeze protection device, the expansion device, the high-pressure cut-out switch, the flush system, and possibly hoses may require replacement. Industry is experimenting with alternative methods and blends of hydrofluorocarbons (HFCs) to find the most efficient system and cost-effective methods. However, the best alternative thus far appears to be HFC-134a. The automobile industry replacement of CFC-12 systems by HFC-134a has already begun. New cars are being produced with HFC-134a systems and, by 1995, all new cars will have HFC-134a systems installed.

Conversion to an HFC-134a system should be evaluated based on an assessment of leakage from vehicles. If a system is leaking noticeably, then the decision to retrofit is recommended. The decision to retrofit should be based on an assessment of leakage, the length of time of expected ownership of the car and an expected life of ten years for an automobile. The cost of CFCs and the expected obsolescence of equipment dependent on CFC-12 by 1997 or 1998 at the latest should be weighed against the cost and benefits of early retrofit. A possible result of the CFC-12 shortfall is that EPA may make it illegal to service cars with CFC-12 and will require auto owners to have the systems replaced with HFC-134a
(The News 1993b).

Refrigerant management should be continued as a best management practice even after retrofit with HFCs. As of November 15, 1995, the requirements within Section 609 are effective for all substitute refrigerants. Thus, substitutes will be required to be recovered and recycled prior to reuse. HFC-134a, which has SAE Standards similar to those for CFC-12, can and should also be recycled even prior to the November 1995 date.

11.0 DESTRUCTION AND DISPOSAL OF CFC REFRIGERANTS

Under the *Montreal Protocol on Substances that Deplete the Ozone Layer*, surplus ozone-depleting substances, including CFCs and HCFCs, must be destroyed using acceptable technology once they are no longer required for servicing existing equipment. Destruction technologies for class I and II ozone-depleting substances are required to achieve a 99.99% efficiency rate. Most class I refrigerants will likely be needed for servicing existing equipment; hence disposal and destruction will not pose immediate concerns for most users. Refrigerants will need to be properly destroyed if they become so contaminated or complex that they can no longer be effectively recycled and used.

A number of possible destruction techniques for CFCs have been identified, including thermal incineration, catalytic incineration, pyrolysis, chemical and metal scrubbing/destruction, wet air oxidation, and supercritical water oxidation, as well as some biological and electrical processes (UNEP 1989). Only thermal incineration is currently available and is a proven technique for CFC destruction; however, 99.99 percent destruction has not been achieved. Thermal incineration also creates secondary wastes requiring control and proper disposal.

The EPA has not issued regulations for disposal or destruction of CFCs, beyond requiring that CFCs be removed from equipment before equipment disposal. Section 608 of the Clean

Air Act prohibits venting, release, or disposal of a class I or II ozone-depleting substance in any manner which permits that substance to enter the environment. Evacuation prior to disposal must meet the requirements listed in Table 2 and Table 3. Equipment used to evacuate refrigerant from MVACs and MVAC-like appliances before they are disposed of must be capable of reducing the system pressure to 102 mm of mercury vacuum (4 inches) under the conditions of the SAE Standard, SAEJ1990 (Appendix A to 40 CFR Part 82, Subpart B).

Persons who conduct the final disposal of small appliances, MVACs, or MVAC-like equipment must either recover any refrigerant remaining in the appliance, or verify that the refrigerant has been previously evacuated from the appliance, through a signed statement from the person who recovered the refrigerant, including the address of the person and date of recovery. This rule may affect disposal of DOE's surplus refrigerators, water coolers, ice machines, etc. All persons recovering refrigerant from MVACs or MVAC-like appliances for disposal must reduce the system pressure to or below 102 mm of mercury vacuum under the conditions of the SAE Standard, SAEJ1990.

Where disposal or destruction of CFCs is required, DOE facilities should ensure that it is undertaken in a manner which would achieve compliance with the Clean Air Act and the *Montreal Protocol*. DOE has significant experience in managing hazardous waste and is well positioned to manage the destruction and disposal of its CFC refrigerants. As the need to destroy and dispose of ozone-depleting substances increases, industry is likely to invest in destruction technologies.

12.0 CONCLUSIONS

DOE's goal is to phase out the use of ozone-depleting substances by implementing environmentally safe alternative substances and processes within a timeframe that is consistent with the requirements and spirit of Executive Order 12843 and Title VI of the Clean Air Act. In order to effectively plan for the phaseout of ozone-depleting substances in refrigeration and air conditioning applications, DOE facilities need to identify and prioritize their current applications and develop plans to replace or convert these uses. The approach outlined in this document should assist facilities in developing long-range plans that will minimize the impacts of the CFC phaseout. For this reason, the approach followed in this document encompasses environmental regulatory requirements as well as suggested approaches for long-range planning, energy efficiency considerations, and overall refrigerant management.

As concerns over the availability of alternative refrigerants and equipment grow, it becomes increasingly important for DOE facilities to plan for the transition from ozone-depleting refrigerants. Although increasing the burden on facilities, the phaseout of ozone-depleting chemicals also provides facilities with opportunities to increase energy efficiency of HVAC equipment, and to identify alternatives that provide maximum protection to human health and the environment.

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APPENDIX A - EPA'S SIGNIFICANT NEW ALTERNATIVES PROGRAM (SNAP)

ACCEPTABLE ALTERNATIVES FOR REFRIGERATION APPLICATIONS UNDER THE SIGNIFICANT NEW ALTERNATIVES POLICY (SNAP) PROGRAM [1] (59 FR 13122)

The EPA's Significant New Alternatives Policy (SNAP) program was developed to review alternative chemicals and technologies that are acceptable substitutes[2] for CFCs and other ozone-depleting substances. Acceptability is determined based on environmental and human health and safety data on the substitute, as well as the potential applications in which the substitute will be used.

Refrigeration Application	Chemical Substitute	Alternative Technologies
CFC-11 Centrifugal Chillers (Retrofits)	HCFC-123[3]	
CFC-11 Centrifugal Chillers (New Equipment/Alternative Substances)	HCFC-123, HCFC-22, HCFC-124, HFC-134a[4], HFC-227ea	Ammonia Vapor Compression Water/Lithium Bromide absorption Ammonia/water absorption Evaporative cooling Desiccant cooling
CFC-12 Centrifugal Chillers (Retrofits)	HFC-134a	
CFC-12 Centrifugal Chillers (New Equipment/Alternative Substances)	HFC-134a, HCFC-123, HCFC-22, HCFC-124, HFC-227ea	Ammonia Vapor Compression Lithium Bromide/water absorption Ammonia/water absorption Evaporative cooling Desiccant cooling
CFC-12 Reciprocating Chillers (Retrofits)	HFC-134a	

[1] Under CAA Section 612, EPA is required to evaluate potential ozone-depleting substance substitutes by use to determine human health risks. The goal of the program is to prohibit substances that are "unacceptable." This program is being called the SNAP program. The substitutes in this table are from the final rulemaking issued on March 18, 1994 (59 FR 13122).

[2] The EPA's final rule also lists substances that are unacceptable as substitutes and substances for which a decision on acceptability is still pending.

[3] Use of HCFCs is subject to (1) the no venting during servicing prohibition under Clean Air Act Title VI Section 608, which was effective July 1, 1992, (2) recycling requirements under Section 608 once they are promulgated, (3) Section 609 motor vehicle air conditioning regulations, (4) the phaseout schedule for all class II chemicals under Section 605, and (5) mandatory recycling.

[4] Use of HFCs is subject to the no venting prohibition under Section 608(c)(2), which takes effect November 15, 1995, at the latest.

Refrigeration Application	Chemical Substitute	Alternative Technologies
CFC-12 Reciprocating Chillers (New Equipment/Alternative Substances)	HCFC-22, HFC-134a, HFC-227ea	Evaporative cooling Desiccant cooling Stirling cycle
CFC-12 Household Refrigerators (Retrofits)	HCFC-22, HFC-134a, R-401A [5], R-401B, HCFC blend alpha	
CFC-12 Household Refrigerators (New Equipment/Alternative Substances)	HFC-134a, HFC-152a, HCFC-22, HCFC blend alpha, R-200B	Stirling cycle
CFC-12 Cold Storage Warehouses (Retrofits)	HCFC-22, HFC-134a, R-401A, R-401B, R-402A, R-402B, R-404A, R-507 [6]	
CFC-12 Cold Storage Warehouses (New Equipment/Alternative Substances)	HFC-134a, HCFC-22, HFC-227ea, R-402A, R-402B, R-404, R-507	High to Low Pressure Stepdown Process Ammonia Vapor Compression Evaporative cooling Desiccant cooling Stirling cycle
CFC-12 Water Coolers (Retrofits)	HFC-134a, R-401A, R-401B	
CFC-12 Water Coolers (New Equipment/Alternative Substances)	HCFC-22, HFC-134a	Stirling cycle
CFC-12 Mobile Air Conditioners (Retrofits)	HFC-134a, R-401C	
CFC-12 Mobile Air Conditioners (New Equipment/Alternative Substances)	HFC-134a	Evaporative cooling CO_2 Stirling cycle
CFC-12 Refrigerated Transport (Retrofits)	HCFC-22, HFC-134a, R-401A, R-401B, R-402A, R-402B, R-404A, R-507	
CFC-12 Refrigerated Transport (New Equipment/Alternative Substances)	HCFC-22, HFC-134a, R-402A, R-402B, R-404A, R-507	Stirling cycle Nitrogen direct gas expansion

[5] The R-400 series refrigerants and HCFC blends are subject to containment and recovery regulations covering HCFCs

[6] EPA strongly recommends the containment and reclamation of this substitute.

Refrigeration Application	Chemical Substitute	Alternative Technologies
CFC-114 Centrifugal Chillers (Retrofits)	HCFC-124	
CFC-114 Centrifugal Chillers (New Equipment/Alternative Substances)	HCFC-124, HCFC-123, HCFC-22, HFC-134a, HFC-227ea	Ammonia vapor compression Water/Lithium Bromide absorption Ammonia/water absorption Evaporative cooling Desiccant cooling
CFC-500 Centrifugal Chillers (Retrofits)	HFC-134a	
CFC-500 Centrifugal Chillers (New Equipment/Alternative Substances)	HFC-134a, HCFC-123, HCFC-22, HCFC-124, HFC-227ea	Ammonia Vapor Compression Lithium Bromide/water absorption Ammonia/water absorption Evaporative cooling Desiccant cooling
CFC-500 Refrigerated Transport (Retrofits)	HCFC-22, HFC-134a, R-401A, R-401B, R-402A, R-402B, R-404A, R-507	
CFC-500 Refrigerated Transport (New Equipment/Alternative Substances)	HCFC-22, HFC-134a, R-402A, R-402B, R-404A, R-507	
CFC-502 Cold Storage Warehouses (Retrofits)	HCFC-22, HFC-134a, R-401A, R-401B, R-402A, R-402B, R-404A, R-507	
CFC-502 Cold Storage Warehouses (New Equipment/Alternative Substances)	HFC-134a, HCFC-22, HFC-227ea, R-402A, R-402B, R-404, R-507	High to Low Pressure Stepdown Process Ammonia vapor compression Evaporative cooling Desiccant cooling Stirling cycle

Refrigeration Application	Chemical Substitute	Alternative Technologies
CFC-11, CFC-12, R-502 Industrial Process Refrigeration (Retrofits)	HCFC-22, HFC-134a, R-401A, R-401B, R-402A, R-402B, R-404A, R-507	Ammonia vapor compression Propane[7] Propylene Butane Hydrocarbon Blend A Chlorine[8]
CFC-11, CFC-12, R-502 Industrial Process Refrigeration (New Equipment/Alternative Substances)	HCFC-22, HFC-134a, HFC-227ea, R-402A, R-402B, R-404A, R-507	Ammonia vapor compression Propane Propylene Butane Hydrocarbon blend A Chlorine Evaporative cooling Desiccant cooling Stirling cycle
CFC-502 Refrigerated Transport (Retrofits)	HCFC-22, HFC-134a, R-401A, R-401B, R-402A, R-402B, R-404A, R-507	
CFC-502 Refrigerated Transport (New Equipment/Alternative Substances)	HCFC-22, HFC-134a, R-402A, R-402B, R-404A, R-507	Stirling cycle Nitrogen direct gas expansion

[7] EPA recommends that hydrocarbon substitutes be only used at industrial facilities that manufacture or use hydrocarbons in the process stream.

[8] EPA recommends that chlorine be only used at industrial facilities that manufacture or use chlorine in the process stream.

APPENDIX B - EPA LISTING OF SECTION 608 TECHNICIAN CERTIFICATION PROGRAMS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

June 29, 1994

SECTION 608 TECHNICIAN CERTIFICATION PROGRAMS

This list will be updated when other technician certification programs are approved.. programs appearing on this list are approved to provide the "EPA technician certification test; however, this approval list does not address the status of technicians that participated in any voluntary training and/or certification program. Issues concerning previously trained technicians will be addressed at a future date. Programs offering Type I tests using the mail-in option, are noted. Unless otherwise indicated, those programs also provide on-site testing. In addition, EPA does not review or approve any training programs or materials. Please note: The addresses and phone numbers listed below are for the programs' headquarters. Many programs offer testing locations throughout the country. Each program will be able to provide you with their testing locations.

AC/C Tech
4415 N. Forest Manor Avenue
Indianapolis, Indiana 46226-3080
(317) 545-7071
Fee: $25.00
training available
approved: 10/13/93

AcuPro Refrigerant Recovery
1217 West Hatcher Road
Phoenix, Arizona 85021
(602) 867-1836
fee: $40.00
training available
approved: 5/31/94

Advanced Technical Training
45 South Victoria
Suite 139
Milpitas, California 95035
(408) 534-3139
fee: $15.00
training available .
approved: 6/29/94

Air Conditioning Contractors of America
(ACCA)/Ferris State University (FSU)
1513 16th Street
Washington, DC 20036
(202),483-9370
Fee: $20.00 members
$30.00 nonmembers
$99.00 electronic testing
training available
approved: 9/30/93

Air-Conditioning & Refrigeration
Institute (ARI)
4301 North Fairfax Drive
Suite 425
Arlington, Virginia 22203
(703) 524-8800
Fee: $45.00
training materials available
approved: 9/30/93

Alaska Vocational Technical Center
P.O.Box 889
Seward, Alaska 99664
(907) 224-3322
fee: $35.00 for non-members of AVTEC
training available
approved: 6/29/94

Apex Technical School, Inc.
635 Avenue of the Americas
New York, New York 10011
(212) 645-3300
fee: $30.00
training available
approved: 6/29/94

Association Of Energy Engineers
4025 Pleasantdale Road, Suite 420
Atlanta, Georgia 30340
(404) 447-5083 ext. 215
fee: $50.00
training available
approved: 1/26/94

Association of Home Appliance Manufacturers (AHAM)/National Association of Retail Dealers of America (NARDA)
10 East 22nd Street
Suite 310
Lombard, Illinois 60148
(708) 953-8950
fee: $22.00
Type I mail-in tests only
training manuals available
approved: 12/28/93

Associated Technical Institute (ATI)
345 West Cummings Park
Woburn, Massachusetts 01801
(617) 935-3838
fee: $25.(')0
training available
approved: 12/28/93

Bay State School of Appliances (BSSA)
225 Turnpike Street (Route 138)
Canton, Massachusetts 02021
(617) 828-3434
fee: $75.00
training available
approved: 2/23/94

C.F.C. Reclamation and Recycling Semite, Inc.
P.O. Box 560
Abilene, Texas 79604
(915) 675-5311
fee: $100.00
training available
approved: 12/28/93

Climate Control Institute, Inc.
3030 North Hillside
Wichita, Kansas 67219
(316) 686-7355
fee: $50.00
training available
approved: 2/23/94

County Trade School
837 New Haven Avenue
Melbourne, Florida 32901
(407) 725-7222
fee: $50.00 (may be included in student tuition)
training available
approved: 4/28/94

Delaware County Community College (DCCC)
Route 252 and Media Line Road
Media, Pennsylvania 19063
(610) 359-5338
Fee: $25.00
training available
approved: 11/4/93

Delaware Technical & Community College
Industrial Training Division
400 Stanton-Christiana Road
Newark, Delaware 19713
(302) 453-3001
fee: $30.00 for Type I, Type II, or Type 111
$40.00 for Universal
training available
approved: 4/28/94

I.M./Thrifty Distribution Inc.
4403 S.E. Johnson Creek Blvd.
Portland, Oregon 97222
(800) 747-0824
fee: $50.00
training available
approved: 1/26/94

Kellogg Community College
Regional Manufacturing Technology Center
405 Hill-Brady Road
Battle Creek, Michigan 49015-1060
(616) 965-4137 ext. 2813
fee: $60.00
training available
approved: 2/23/94

Metropolitan Manufacturers Association
P.O. Box 21734
St. Louis, Missouri 63109-0734
(314) 772-4357
fee: $25.00
training available
approved: 2/23/94

Mainstream Engineering Corporation
Pines Industrial Center
200 Yellow Place
Rockledge, Florida 32955
(800) 866-3550
fee: $15.00
training available
approved: 1/26/94

National Assessment Institute/Block & Associates (NAI/Block)
5700 SW 34th Street
Suite 1303
Gainesville, Florida 32608
(800) 280-EXAM (3926)
Fee: $28.00 pre-registered
$24.00 for trainer sponsored groups
$45.00 without pre-registration
no training available
approved: 11/4/93

National Association of Power Engineers (NAPE)
5-7 Springfield Street
Chicopee, Massachusetts 01013
(413) 592-6273
Fee: $55.00
training available
approved: 9/30/93.

National Association of Plumbing-Heating-Cooling Contractors (NAPHCC)
P.O. Box 6808
Falls Church, Virginia 22040
(800) 533-7694
Fee: $15.00 for members
$25.00 for nonmembers
Type I mail-in tests available
training available
approved: 10/13/93

National ITC Corporation
18349 S. Figueroa Street
Gardena, California 90248
(310) 523-1086
fee: $35.00
no training available
approved: 2/23/94

Dundalk Community College
7200 Sollers Point Road
Baltimore, Maryland 21222
(410) 285-9866
fee: $50.00
training available
approved: 6/29/94

Educational Services
Route 5, Box 145
Sparta, Tennesse 38583
(615) 761-5024
fee: $35.00
training available
approved: 6/29/94

Environmental Training Group, Inc.
(ETG)
10716 Little Patuxent Parkway
Suite 220
Columbia, Maryland 21044
(410) 740-1551
Fee: $45.00
training available
approved: 9/30/93

ESCO Institute
1350 W. Northwest Highway
Suite 205
Mount Prospect, Illinois 60056
(800) 726-%96
fee: $50.00
training manual available
approved: 12/28/93

Geneva Steel
P.O.Box 2500
Provo, Utah 84603
(801) 227-9000
fee: $35.00 for one Type
S50 for the Universal test
Type I mail-in tests available
training available
approved: 4/28/94

Hartsog Trade School ,
831 E. Industrial Way
Suite D
Lodi, California 95240'
(209) 339-9324
fee: $50.00
training available
approved: 3/30/94-.

H. V.A.C. Tech Inc.
136 Metropolitan Avenue
Brooklyn, New York 11211
(718) 388-6926
fee: $25.00
training available
approved: 3/30/94

Joliet Junior College
Business Assistance & Training Center
214 North Ottawa Street
Joliet, Illinois 60431
(815) 727-6544 ext. 1317
fee: $39.00
training available
approved: 3/30/94

Johnson Controls, Inc.
Controls Group
507 East Michigan Street
Post Office Box 423
Milwaukee, Wisconsin 53201-0423
(414) 274-4000
fee: $45.00 for on-site testing
$30.00 for Type I tests using the mail-in format
Type I mail-in tests available
training available
approved: 1/26/94

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States , and Canada (UA)
901 Massachusetts Avenue, NW "
Washington, DC 20001
(202) 628-5823
Fee: free
training available
approved: 9/30/93

Universal Technical Institute (UTI)
902 Capitol Avenue
Omaha, Nebraska 68102-9954
(402) 345-2422
fee: free for students
$20.00 . us $15.00 for the first test type and $10.00 for each additional test type (Universal tests: $50.00)
training available
approved: 9/30/93

Universal Technical Institute (UTI)
3002 North 27th Avenue
Phoenix, Arizona 85017
(602) 271-4174
Fee: $25.00
training available
approved: 11/4/93

University of Toledo "
Community and Technical College
Toledo, Ohio 43606
(419) 531-3313
fee: $50.00
training available
approved: 4/28/94

VG1 Training Division (VGI)
Video General Inc.
1156 107th Street
Arlington, Texas 76011
(800) 886-4109
fee: $35.00
training available
approved: 9/30/93

William Rainey Harper College "
CAD and Manufacturing Center
1200 West Algonquin Road
Palatine, Illinois 60067-7398
(708) 397-1640
fee: $30.00
training available
approved: 5/31/94

The programs listed below are intended ***specifically for the employees of there companies.***

Amtrak Technical Training Center
National Railroad Passenger Corporation
202 Garstang Street
Beech Grove, Indiana 46107
(317) 263-0516
fee: free
training available
approved: 2/23/94

Calhoon MEBA Engineering School
27050 St. Michaels Road
Easton, Maryland 21610
(410) 822-9600
fee: free (offered only to members of the Marine Engineering Beneficial Association. Fees associated with retesting only.)
training available
approved: 6/29/94

Sequoia Institute
420 Whitney Place
Fremont, California 94539
(5 10) 490-6900
Fee: $10.00
training available
approved: 10/13/93

Southwestern-Technical Center -----"
4426 West 86th Street
Tulsa, Oklahoma 74132
(918) 627-7200 ext. 352
fee: $100.00
training available
approved: 5/31/94

State University of New York--
Maritime College
6 Pennyfield Avenue
Fort Schuyler, New York 10465-4198
(718) 409-7340
fee: $25.00
training available
approved: 5/31/94

Technical Career Institutes (TCI)
The College of Technology
320 West 31st Street
New York. New" York 10001
(212) 594-4000
fee: $30.00
training available
approved: 12/28/93'

Technical Seminars
P.O. Box 1664
Melrose Park, Illinois 60160
(708) 495-2633
fee: $30.00
training available
approved: 12/28/9.7

Technology Training Inc.
6333 South Yates Court
Littleton, Colorado 80123
(303) 798-7030
fee: $50.00
training available
approved: 5/31/94

Tennessee Valley Technical Programs
Route 1, Box 372
Counce, Tennessee 38326
(901) 373-3992
fee: $20.00
training available
approved: 2/23/94

Texas Engineering Extension Service
(TEEX)
The Texas A&M University System
9350 South Press "
San Antonio, Texas 78223-4799
(210) 633-1000
Fee: $40.00
training available
approved: 11/4/93 "

Texas State Technical College at Waco
Air Conditioning and Refrigeration
Technology
3801 Campus Drive
Waco, Texas 76705
(317) 867-4850
fee: $25.00
training available
approved: 3/30/94

Refrigerant Certification Services
8203 Willow Place South
Suite 110
Houston, Texas 77070-9998
(800) 597-9291
fee: $50.00
Type I mail-in tests available
training available
approved: 3/30/94

Refrigeration Environmental Protection Association (REPA)
7525-M Connelley Drive
Hanover, Maryland 21076
(800) 435-3331
Fee: $45.00
training available
approved: 9/30/93

The Refrigeration School, Inc. (RSI)
4210 East Washington Street
Phoenix, Arizona 85034-1894
(602) 275-7133
Fee: $75.00 (may be included in tuition)
training available
approved: 11/4/93

Refrigeration Service Engineers Society (RSES)
1666 Rand Road
Des Plaines, Illinois 600]6-3552
(708) 297-6464
Fee: $25.00
Type I mail-in tests available
training available
approved: 9/30/93

Rock Valley College
3301 North Mulford Road
Rockford, Illinois 6114-5699
(815) 654-4295
fee: $30.00
training available
approved: 3/30/94

San Diego City College
1313 12th Avenue
San Diego, California 92101
(619) 230-2569
fee: $35.00
training available
approved: 4/28/94

San Joaquin Delta College
5151 Pacific Avenue
Stockton, California 95207-6370
(209) 474-5230
fee: $35.00
training available
approved: 5/31/94

San Jose City College (SJCC)
2100 Moorpark Avenue
San Jose, California 95128-2799
(408) 298-2181 ext. 3781
fee: $5.00 processing fee for current SJCC students
$50.00 for non-students
training available
approved:2/23/94

Seafarer's Harry Lundeberg School of Seamanship
P.O. Box 75
Piney Point, Maryland 20674
(301) 994-0010 ext. 274
fee: free for members of the Seafarers International Union
Non-members: $110.00 per test type or $130.00 for Universal
training available
approved:4/28/94

North Carolina State Board of
Refrigeration Examiners
P.O. Box 30693'
Raleigh, North Carolina 27622
(919) 781-1602
Fee: $25.00
training available from the Board's test sites
approved: 9/30/93

Northeast Institute (NI)
2643 Main Street
Buffalo, New York 14214
(716)838-6984
fee: $10 registration fee and $25.00 testing fee
training available
approved: 1/26/94

Oklahoma State University /Okmulgee
1801 East 4th Street
Okmulgee, Oklahoma 74447-3901
(908) 756-6211 ext. 270
fee: $20.00
training available
approved: 5/31/94

Operating and Maintenance Engineer"
Trade Training Trust Fund for California and Nevada (OME)
2501 W. Third Street
Los Angeles, California 90057
(213) 385-2889
Fee: $25.00 for training participants
$50.00 for non-training participants
training available
approved: 10/13/93

Pace Maintenance and Technical
Services Department
Pace Acceptance Facility
405 Taft Drive
South Holland, Illinois 60473
(708) 331-9127
fee: $10.00.
training available
approved:4/28/94

Pennco Tech
99 Erial Road
P.O. Box 1427
Blackwood, New Jersey 08012
(609) 232-0310
fee: $25.00
training available
approved:4/28/94

PowerSafety International
Indiana Learning Center
325 Ferguson Road
Homer City, Pennsylvania 15748
(412) 479-3585
fee: $50.00
training available
approved: 1/26/94

Ranken Technical College
431 Finney Avenue
St. Louis, Missouri 63113
(314) 371-0236
fee: $20.00 registration
$15.00 first test type
$10.00 additional test type
$50.00 universal tests
(fees may be included in tuition)
training available
approved:3/30/94

Commonwealth Edison Company
Production Training Center
36400 South Essex Road
Wilmington, Illinois 60481
(815) 458-3411 ext. 4822
fee: free
training available
approved: 3/30/94

Department of Defense
366 TS/TSIM, Stop 43
727 Missile Road
Sheppard AFB, Texas 76311-2254
approved: 5/19/94
Note: programs" formerly offered by the U. S. Air Force (approved on 1/26/94) and by the Department of the Navy (approved on 2/23/94) are now pan of this DOD program.

Department of Veterans Affairs
Education and Training Center for Engineering & Construction Management (138E)
VA Medical Center
North Little Rock Division
2200 Fort Roots Drive
North Little Rock, Arkansas 72114-1706
(501) 370-6618
fee: free (VA employees and associated personnel only)
training available
approved: 2/23/94

General Services Administration (GSA)
Real Property Management and Safety
Facility Management Division (PMF)
18th and F Street, NW, Room 4318
Washington, DC 20405
(202) 501-0429
fee: free
training available
approved: 9/30/93

Martin Marietta Energy Systems
P.O. Box 2003
Oak Ridge, TN 37831-7242
(615) 574-9514
fee: $10.00 Type I
$15.00 Type II, 111, Universal
training available
approved: 3/30/94

National Aeronautics and Space Administration (NASA)
Lockheed Space Operations Company (LSOC)
Mail Code: DE-EMO
Kennedy Space Center, Florida 32899
(407) 867-4049
fee: free (NASA/LSOC employees only)
training available
approved: 6/29/94

National Training Fund (NTF)
601 North Fairfax Street
Alexandria, Virginia 22314
(703) 739-7200
fee: free (offered only to members of Sheet Metal and Air Conditioning National Contractors Association, Inc. and the Sheet Metal Workers International Association)
training available
approved: 2/23/94

New York City Transit Authority
(NYCTA)
NYCTA Learning Center
2125 West 13 Street
Brooklyn, New York 11223
(718) 265-4267
fee: free
training available
approved: 9/30/93

Norfolk Naval Shipyard
Code 950/970T - Training Department
Building 510-5th
Portsmouth, Virginia 23709
(804) 396-1223
fee: free (Norfolk Naval Shipyard employees and associated personnel only)
training available
approved: 5/31/94

Peoples Natural Gas (PNG)
Safety and Technical Training
1815 Capitol Avenue
Omaha, Nebraska 68102
(402) 221-2458
fee: free
training available
approved: 1/26/94

Sears Product Services
E5-123A
3333 Beverly Road
Hoffman Estates, Illinois 60179
708-286-1358
fee: free
training available
approved: 1/26/94

Union Electric Company
1599 Fenpark Drive
Fenton, Missouri 63026
(314) 992-7433
fee: free
training available
approved: 4/28/94

United States Coast Guard
Reserve Training Center
Yorktown, Virginia 23690-5000
(804) 898-2362
fee: free (Coast Guard and associated personnel only)
training available.
approved: 5/31/94

U.S. Postal Semite - Technical Training
Post Office Box 1400
Norman, Oklahoma 73070
(405) 366-4351
fee: free - Postal Service employees
$20.00 non-Postal Service employees
training available
approved: 5/31/94

York International Corporation
P.O. Box 1592 - 36BE
York, Pennsylvania 17405
(717) 771-6144
fee: free
training available
unproved: 3/30/94

APPENDIX C - EPA LISTING OF SECTION 609 TECHNICIAN CERTIFICATION PROGRAMS

SECTION 609 TECHNICIAN CERTIFICATION PROGRAMS[1]

February 1, 1994

CFC Reclamation and Recycling Service, Inc.
P.O. Box 560
Abilene, TX 79604
(915) 675-5311
approval date: 3/31/93

The Greater Cleveland Automobile Dealers' Association
6100 Rockside Woods Boulevard, Suite 235
Independence, OH 44131
(216) 328-1500
approval date: 8/12/92
grandfathering: since 1/92

International Mobile Air Conditioning Association
P.O. Box 9000
Fort Worth, TX 76147-2000
(817) 338-1100
approval date: 6/29/92
grandfathering: since 5/91

Mechanic's Education Association
1805 Springfield Avenue
Maplewood, NJ 07040-2910
(201) 763-0086
approval date: 3/30/93

Mobile Air Conditioning Society
P.O. Box 97
East Greenville, PA 18041
(215) 541-4500
approval date: 6/12/92
grandfathering: since 9/30/90

National Institute of Automotive Service Excellence
13505 Dulles Technology Drive
Herndon, VA 22071-3415
(703) 713-3800
approval date: 6/29/92
grandfathering: since 10/91

[1] Source: U.S. Environmental Protection Agency

New York State Association of Service Stations and Repair Shops, Inc.
8 Elk Street
Albany, NY 12207
(518) 434-6102
approval date: 8/12/92

Rancho Santiago College
17th at Bristol Street
Santa Ana, CA 92706
(714) 564-6661
approval date: 8/12/92

Refrigerant Certification Services[2]
11902 Jones Road, #238-L
Houston, TX 77070
(713) 894-6897
approval date: 4/19/93

Snap-on Tools Corporation
2801 80th Street
Kenosha, WI 53141-1410
(414) 656-5200
approval date: 3/30/93
grandfathering: since 3/1/92

Texas Engineering Extension Service
San Antonio Training Division
The Texas A & M University System
9350 South Presa
San Antonio, TX 78223-4799
(512) 633-1000
approval date: 3/30/93
grandfathering: since 9/17/92

Waco Chemicals, Inc.
12306 Montague Street
Pacoima, CA 91331
(818) 897-3018
approval date: 7/13/93
grandfathering: since 12/1/91

[2] Only RCS technicians with credentials dated after April 19, 1993, will be considered trained by an EPA-approved certifying program.

The programs listed below are intended specifically for the employees of these companies

Geneva Steel
P.O. Box 2500
Provo, UT 84603
(801) 227 - 9000
approval date: 2/4/93
grandfathering: since 10/19/92

Jiffy Lube International
P.O. Box 2967
Houston, TX 77252-2967
(713) 546-4100
approval date: 9/14/93

Kmart Corporation
East/Central Regional Office
Auto Training Center
551 North Hicks Road
Palatine, IL 60067
(708) 358-3205
approval date: 8/12/92

Los Angeles County Metropolitan Transportation Authority (MTA)
900 Lyon Street
Los Angeles, CA 90012
(213) 972-5159
approval date: 2/1/94
grandfathering: since 1/16/92

Minnesota Department of Transportation
Central Services Building
Central Shop Unit
6000 Minnehaha Avenue South
St. Paul, MN 55111
(612) 725-2345
approval date: 2/1/94

Potomac Electric Power Company
8400-B Old Marlboro Pike
Upper Marlboro, MD 20772
(301) 967-5294
approval date: 8/12/92
grandfathering: since 5/92

Ryder Truck Rental
3600 NW 82nd Avenue
P.O. Box 020816
Miami, FL 33102-0816
(305) 593-3684
approval date: 8/12/92

Whayne Supply Company
P.O. Box 35900
Louisville, KY 40323-5900
(502) 774-4441
approval date: 7/19/93
grandfathering: since 2/1/92

U.S. Army Ordnance Center and School
Attn: ATSL-DT-TD2-TS
Aberdeen Proving Ground
Aberdeen, MD 21005-5201
(410) 278-4099
approval date: 8/12/92

Yellow Freight System, Inc.
10990 Roe Avenue
P.O. Box 7270
Overland Park, KS 66207
(913) 345-3000
approval date: 8/12/92