

# Save Money and the Environment with an Energy-Efficient CFC Solution

Chlorofluorocarbons (CFCs) are stable compounds commonly used as refrigerants in air conditioners. Unfortunately, many of the chemical properties that make CFCs great refrigerants also enable them to destroy the earth's protective ozone layer. To guard the ozone layer from further depletion, the US joined many nations of the world in an agreement, commonly called the Montreal Protocol, to phase out production of CFCs. The production of CFCs became illegal in the United States as of January 1, 1996. The less-harmful, but still ozone-depleting hydrochlorofluorocarbons (HCFCs), often used as a "bridge" refrigerant, will be phased out of production over the next 20 years. Despite similar regulation by other industrialized nations, the hole in the ozone layer over Antarctica in the fall of 1998 was the largest yet observed.

If you are a property owner or manager who hasn't yet begun managing your CFC-based refrigeration systems, this page provides an overview of options and suggestions for how to get started. If you are ready to move ahead with your refrigerant management program, this page has links to technical information about CFCs and chillers to help you along.

## What are The Options for CFC-Based Refrigeration Systems?

Essentially, you have three options for dealing with CFC-based refrigeration systems - you can better contain refrigerant in your existing equipment, convert to an alternative refrigerant, or replace your equipment with energy-efficient equipment that does not use CFCs.

- Contain your CFC refrigerant more effectively through leak detection, equipment repairs, refrigerant recovery and installation of high-efficiency purges. Since CFC refrigerant costs are expected to rise over time as they become more scarce, this strategy may not save money in the long run.
- Convert to alternative refrigerants such as non-CFC HFC-134a or transitional HCFC-123. This may be the best solution for equipment with a long remaining lifetime. However, switching an existing compressor to alternative refrigerants typically decreases the cooling capacity of the unit by 20%. While this may not be a problem if your system was over-sized to begin with (as many are) you may need to make building energy efficiency improvements to reduce cooling loads in conjunction with switching to alternative refrigerants.
- Replace old or inefficient chillers and cooling towers with new CFC-free energy-efficient models. Here is an opportunity to improve energy efficiency and performance, while decreasing the impact on the ozone layer. While this option requires greater capital commitment, it also offers significant savings in energy, maintenance, and refrigerant costs. In many cases, reducing cooling loads, as well as purchasing properly sized chillers and support systems for your operating conditions, can result in a quick return on your investment.

Considering the eight factors below can help you assess whether to maintain, retrofit or replace each piece of equipment:

- age and remaining life of existing equipment
- hours of usage
- maintenance and repair history
- refrigerant and equipment supply and possible alternatives
- energy and capacity trade-offs
- equipment upgrades
- building modernization schedule
- energy efficiency rebates or other incentives from utility companies

### **Getting Started: Three Steps Forward**

Although there is no single best approach to the transition from CFC refrigerants to substitutes, it is clear that the worst action in refrigerant management is no action. There are three steps that owners and managers can take immediately:

#### **1. Designate a Facility Refrigerant Manager**

Every equipment owner should put someone in charge of writing and carrying out a plan to manage refrigerant. The refrigerant manager will need clear authority and the necessary budget to effect change. The candidate should be knowledgeable about the facility's HVAC/R operations, industry standards, and relevant federal, state, and local regulations. The manager must also be able to successfully coordinate and communicate with other facility departments.

#### **2. Conduct an Inventory of Equipment and Refrigerants**

Detailed records of equipment stocks and refrigerant are essential for making informed decisions about the transition to new refrigerants. Priority should be given to equipment with the largest charge. Inventory sheets should individually list chillers and pieces of commercial refrigeration equipment. Information is needed on the manufacturer, model, serial number, year installed, capacity in tons, charge size, leak rates (based on records of recharging or 'topping off'), refrigerant type (CFCs, HCFCs, and HFCs), and location. Small appliances--such as household refrigerators and window air conditioners, package units, vending machines, water coolers, and ice machines--should also be inventoried and can be recorded as groups.

Refrigerant stock will become an increasingly valuable asset as the price rises and supplies decrease each year. The quantity purchased, consumed, disposed of, or reclaimed should be monitored and analyzed. Refrigerant inventories should be kept by type and should include the volume contained in each piece of existing

equipment, as well as amounts that are currently stored. These inventories should be updated regularly. Local codes for storage limits should be consulted.

### 3. Develop a Refrigerant Management Plan

A sound refrigerant management plan is the road map for making the transition to refrigerants that do not destroy the ozone layer. A good plan is based on accurate equipment and refrigerant inventories and takes account of the unique business environment. The plan will help to minimize capital outlays and operating costs while achieving these goals: compliance with applicable laws and regulations, continued supplies and service, reduced emissions, and increased recycling. The plan should combine these actions:

- **Maintaining Existing Equipment.** Conserving CFCs through leak detection, equipment repairs, refrigerant recovery, and installation of high-efficiency purges (in CFC-11 machines) is critically important. Reliance on recycled or reclaimed refrigerants to maintain existing equipment, however, is most viable with large equipment inventories where units can be gradually retired to keep others going. Equipment owners should consider the fact that avoiding capital costs for new equipment now may be offset by increased operating costs later. Purchasing or renting on-site recovery and recycling equipment may keep costs down. Equipment owners and managers should become familiar with EPA regulations governing recovery, recycling, and reclaiming refrigerants.
- **Retrofitting Equipment to Alternative Refrigerants.** The best solution for equipment with a long anticipated lifetime is likely to be its conversion for use with substitute refrigerants. Scheduling retrofits at the time of servicing or major equipment overhauls will keep costs down. Most original equipment manufacturers can be consulted for information on special design requirements (such as compatibility of materials and lubrication) and may be able to analyze the energy and capacity trade-offs of retrofitting.
- **Replacing Old or Inefficient Equipment.** Replacing aging equipment is an opportunity to improve energy efficiency and performance while lessening the impact on the ozone layer. This option requires the greatest initial outlay of capital, but in the long run may yield savings in energy, maintenance, and refrigerant costs. Only equipment that does not use CFCs should be purchased.

The section above was adapted from:

EPA Stratospheric Ozone Protection Action Guide  
United States Environmental Protection Agency  
Air and Radiation (6205J)  
EPA-430-F-93-003 Revised September 1993  
Website: <http://www.epa.gov/ozone/index.html>

## **For More Information**

DOE's Cool \$ense: A network for integrated chiller retrofits, is dedicated to promoting retrofit projects that capitalize on opportunities to reduce cooling requirements and equipment size in conjunction with CFC-management. Integrated chiller retrofits save money in energy, maintenance, and refrigeration costs while benefiting the environment.

Chiller Systems On-line: Provides free information on to cooling equipment, products, and processes. This includes chillers, cooling towers, pumps, water-cooled chillers, refrigerants, Thermal Energy Storage (TES), gas cooling, ASHRAE Fundamentals, air-cooled chillers, condensers, air cooled heat rejection, and air conditioning.

PG&E's CoolTools: This project's objective is to develop, disseminate and promote an integrated set of tools for design and operation of chilled water plants. The CoolTools products are software programs, publications and support services that together provide an objective analytical method for comparing alternatives during the design and operation of chilled water systems. CoolTools supports a new standard of practice for achieving cost effective and efficient equipment selection, system design and operating scenarios. CoolTools products are Internet based, public domain resources, and are targeted to building owners, design professionals, and operators involved in both new construction and retrofits.

EPA's Ozone Depletion Website: Information on ozone depletion, new equipment, replacement substances, and regulations.