

Successful CFC Phaseout Project - Oak Ridge National Laboratory

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Based on Clean Air Act Amendments of November, 1990, which required the phaseout of Class I refrigerants by 2000 and prohibited the intentional venting of Class I refrigerants after July 1, 1992, the ORNL Plant and Equipment (P&E) division developed a strategy to contain existing refrigerant and to retrofit or replace CFC chillers with unregulated or with Class II refrigerants. At that time ORNL refrigerant inventories and usage rates indicated a 25% annual leak rate in 21 centrifugal chillers which contained 39,000 pounds of CFC refrigerant.

P&E began to purchase refrigerant recovery units and train refrigeration mechanics on EPA regulations and on the operation of the refrigerant recovery units in early 1992. In 1992 ORNL purchased Trane's first high-efficiency purge units for use at Building 3047 and Building 7920 with maintenance funds. These units were installed using P&E personnel. Replacement of the old purge units with the high-efficiency units required an aggressive leak repair program to keep the units operational. By 1994 all 18 low pressure chillers at ORNL had been equipped with high efficiency purge units, and leak rates were reduced below 10% to comply with the EPA allowable annual leak rate of 15%. The cost of the new purge units was recovered in the first year by refrigerant savings.

A preliminary request for \$10M was initiated in June, 1991 to replace 21 CFC chillers. In February 1992, the phaseout of CFC production was accelerated to 12/31/95. Line Item and Capital funding requests were made in 1992 based on a more detailed study and cost estimate of \$25M to replace or retrofit the 21 centrifugal chillers. However, DOE indicated that ORNL should resolve this problem with available funding.

With this guidance, P&E developed a multi year plan to retrofit or replace the 21 chillers using ORNL operating funds. Retrofit/replacement priorities were based on the age of machines, operating efficiencies, annual maintenance costs, refrigerant leak rates, and available budget. Capital funds were utilized to replace chillers using Service Subcontracts. Design-Build chiller specifications were developed to include a base bid to retrofit/replace as many chillers as possible using available funds, with options which included additional chillers to be retrofit/replace with future capital funds over the next two year period, if those funds were made available. This contract arrangement provided an incentive for the successful bidder to provide satisfactory performance, and provided ORNL flexibility with funding limitations. The bids were awarded on installed cost and life cycle operating cost and a 10 year payback.

Chillers totaling, 7859 tons capacity, have been installed at Buildings 1505-1 & 2, 2026, 3025, 3047, 4509-1,2,3,4, & 6, 6000N, 6000S, 7900, 7920, and 7930. The replacement projects included refrigerant monitors and exhaust system upgrades to comply with mechanical equipment room safety codes along with three large recovery machines, and six refrigerant storage vessels to improve maintenance capabilities.

As smaller CFC machines require significant work, they are evaluated for conversion or replacement with alternate refrigerants using capital or operating funds. Also, EPA requires that refrigeration units containing more than 50 pounds of refrigerant, Class I or Class II, must be repaired within 30 days if the leak rate exceeds 15% of the total charge during a 12 month period. Therefore, all refrigeration systems containing more than 50 pounds are also being evaluated for replacement when their life expectancy is exceeded or their repair history indicates economic justification for replacement.

The following cost savings have been realized from this effort from 1992 through 1998. Also, current annual savings are indicated.

	<u>since '91</u>	<u>annual</u>
Elimination of CFC emissions/purchases	\$1,200K	\$300K
Reduction of electrical bills (efficiency)	\$800K	\$250K
Reduced Maintenance bills on new machines	\$300K	\$80K
Total	\$2,300K	\$630K

Finally, using the Service Subcontracts/Design Build method of contracting this work, 15 chillers (including the five largest chillers) have been installed at less than half the engineered estimate made in 1992.