



# Project Summary

## Options for Reducing Refrigerant Emissions from Supermarket Systems

Eugene F. Troy

**The report was prepared to assist personnel responsible for the design, construction, and maintenance of retail food refrigeration equipment in implementing practices and technologies to reduce refrigerant emissions. The report characterizes the design of typical supermarket refrigeration systems and focuses on why these types of systems have high rates of refrigerant emissions. Three case studies are provided of companies that have successfully implemented emission-reducing practices and technologies. The report discusses a variety of technical and procedural options that can be applied to existing systems and in new construction.**

***This Project Summary was developed by the National Risk Management Research Laboratory's Air Pollution Prevention Control Division, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).***

### Overview

In 1993, the U.S. Environmental Protection Agency issued regulations as required by Section 608 of the Clean Air Act Amendments of 1990. These regulations, entitled "The National Recycling and Emission Reduction Program", require persons working on refrigeration and air-conditioning systems containing chlorofluorocarbons (CFCs) to maximize the recapturing and recycling of CFCs during the maintenance, service, and disposal of these systems. The provisions of the rule that most affected the supermarket industry were:

- mandatory recovery of refrigerant during equipment service,
- certification of technicians, and
- requirements for leak repair of systems with refrigerant charges of 50 lb (22.7 kg) or more.

Responding to the regulations, many refrigeration engineers, construction mechanics, and maintenance personnel have become more aware of the impact of their equipment specifications and operating procedures on refrigerant emissions. More and more supermarkets are now investing resources to control refrigerant leaks from their refrigeration systems. In this report, three supermarkets—Hannaford Brothers, Shaw's Supermarkets, and Jitney-Jungle Stores of America—have participated in case studies to document various procedures and techniques which have successfully reduced the emissions in their stores.

Hannaford Brothers' program stresses involvement and accountability by all departments involved in refrigeration systems including store design, construction, and maintenance. Hannaford has implemented a design strategy which engineers out the emissions. New stores are constructed with loop piping, no hot-gas defrost, stronger solder joints, and rigorous pressure testing. In addition, Hannaford has worked with equipment manufacturers to develop lower-emission equipment components. Improved maintenance practices have been implemented including weekly inspection of systems for leaks using battery-powered leak detectors. Fixed-cost service and preventive-maintenance contracts are used instead of service-only contracts. As a result of its comprehensive

---

refrigerant management program, Hannaford Brothers has reduced its total refrigerant consumption by 80% in 8 years.

Shaw's Supermarkets identified improvements which could be made in all of its departments, including engineering, construction, and maintenance. As part of its leak reduction efforts, Shaw's began using a computer program which tracks refrigerant usage and monitors service events to better troubleshoot refrigeration systems. Stationary leak detectors have been installed in many stores as an option of the energy management system. Shaw's also began to design systems which reduced charge size in order to minimize the impact of catastrophic leaks. These features include remote headers, heat reclaim pump-out, split condensers, and condenser bypass. Since the company felt that capillary tubes were significant leakers, Shaw's investigated alterna-

tive technologies and materials. Improved maintenance is also an important element of the company's leak reduction strategy. As a result of its efforts, Shaw's Supermarket chain has seen a 44% reduction in refrigerant consumption since 1988, and the computer tracking program indicates a 29% reduction in annual refrigerant leakage over the last two years.

Jitney-Jungle Stores of America developed a program to conserve refrigerant by assessing practices in engineering, service, and maintenance. Engineering changes include the use of vertical, in place of horizontal, receivers and sweat-type (brazed) valves in place of flare-type thermostatic expansion valves. This valve replacement alone has resulted in noticeable reductions in refrigerant emissions. Isolation and access valves have also been installed on frequently serviced components. Since systems which operate at

high temperatures and pressures were identified as those with the most maintenance problems related to leaks, Jitney-Jungle improved mechanical room conditions to reduce operating temperatures and pressures, including the use of electronic controllers and monitors to track these parameters at key points. A refrigerant tracking system has been implemented, and leak detection and repair practices have been improved to augment the existing preventive maintenance program. Jitney-Jungle has also instituted practices to reduce emissions during the conversion of systems from CFCs to alternative refrigerants.

Beyond the practices instituted by the three supermarket chains in the case studies, a variety of additional activities can be implemented with estimated emission reductions ranging from 3% to 25% of the system charge per year.

---

*E. Troy is with ICF, Inc., Washington, DC 20006*

**Cynthia L. Gage** is the EPA Project Officer (see below).

The complete report, entitled "Options for Reducing Refrigerant Emissions from Supermarket Systems," (Order No. PB97-167100; Cost: \$21.50, subject to change) will be available only from:

*National Technical Information Service*

*5285 Port Royal Road*

*Springfield, VA 22161*

*Telephone: 703-487-4650*

The EPA Project Officer can be contacted at:

*Air Pollution Prevention Control Division*

*National Risk Management Research Laboratory*

*U.S. Environmental Protection Agency*

*Research Triangle Park, NC 27711*

United States  
Environmental Protection Agency  
National Risk Management Research Laboratory (G-72)  
Cincinnati, OH 45268

Official Business  
Penalty for Private Use \$300

EPA/600/SR-97/039

BULK RATE  
POSTAGE & FEES PAID  
EPA  
PERMIT No. G-35