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Into the Green

Leak detection program shrinks grocer's carbon footprint and grows its bottom line



Refrigerant leaks are a persistent concern in the commercial refrigeration industry, and forward-thinking grocers are seeking ways to limit leaks, reduce their negative environmental impacts, and avoid the potential for significant Environmental Protection Agency (EPA) fines. For one prominent U.S. supermarket chain, these efforts have even become formalized in a leak detection program that serves as a key component in their corporate sustainability objectives.

With all the attention that’s been brought to the leak detection issue in recent years — via the EPA’s proposed update to Section 608 and the handful of high-profile cases where fines have been handed down for violations — this particular retailer was ahead of the curve. Having already reduced refrigerant leaks to well below industry averages, they also participated in an Emerson Retail Solutions remote leak detection pilot program that promised to identify small leaks early. The program not only enabled the grocer to fix problems faster, it often prevented the occurrence of catastrophic failures from major leaks.

Because fluctuations in refrigerant levels are a normal part of the refrigeration cycle, detecting refrigerant leaks across the complete system is notoriously difficult. Low refrigerant levels

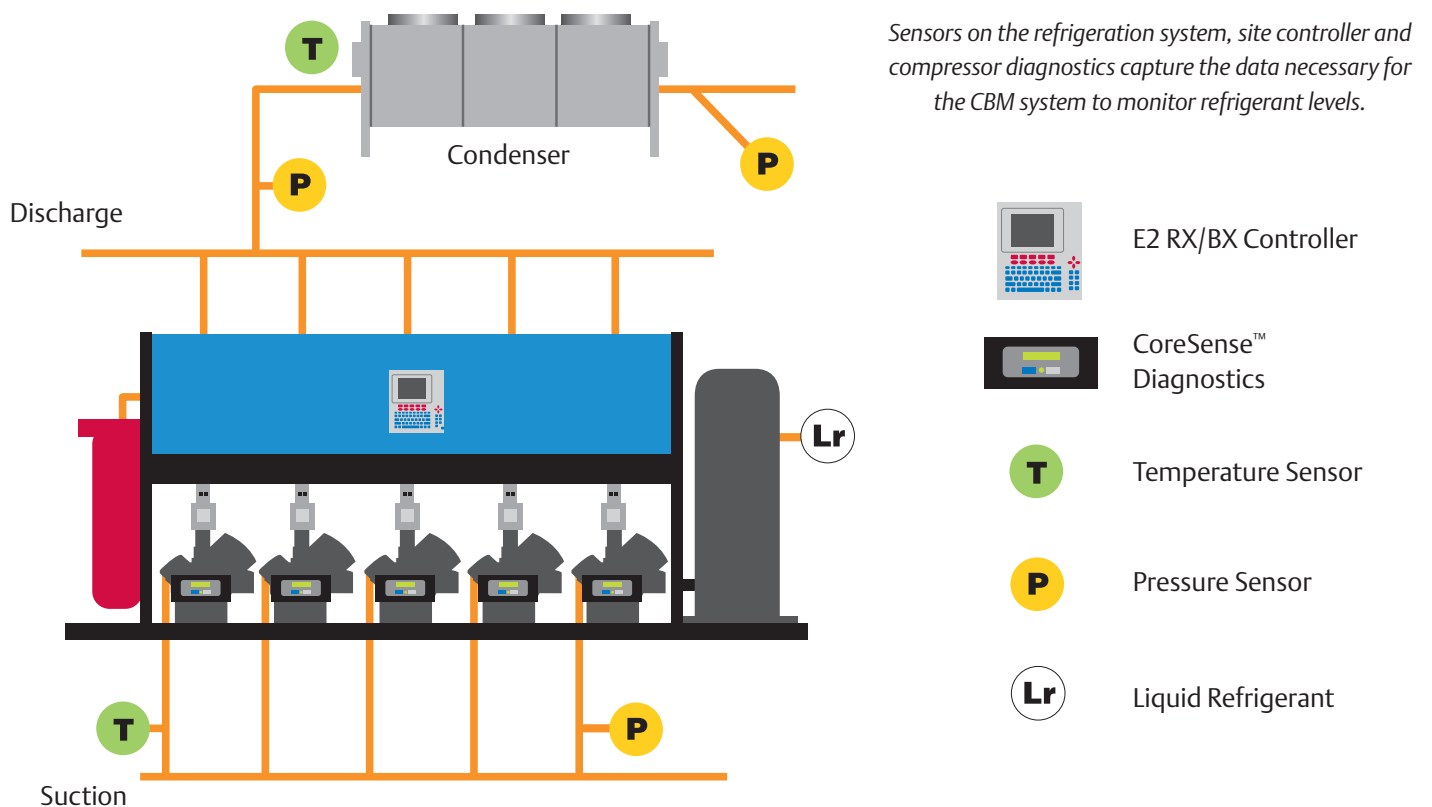
have many damaging consequences on refrigeration system performance, including:

- Excess compressor wear and tear
- Reduced compressor and system capacities
- Premature system failures
- Double-digit efficiency losses

Left undetected, a slow refrigerant leak can turn into a catastrophic failure that has far-reaching operational and business implications, including: food loss, food quality, reputation damage and equipment replacement costs — and the cost of the lost refrigerant, which can be quite substantial on its own. These are all scenarios the retailer wanted to avoid.

Detecting deviations in refrigerant levels

Emerson’s remote slow leak detection program is based on harnessing the power of machine learning technologies to continuously monitor system refrigerant levels and notifying stakeholders when there is a deviation in these levels compared to established models. Unlike “sniffing” leak detection systems, which can only monitor parts of the refrigeration systems typically



located in closed areas, remote leak detection monitors the complete refrigeration system by analyzing key refrigeration operating indicators to provide actionable intelligence.

To capture key performance data in the retailer's network of 100 retail stores, Emerson utilized an existing refrigeration management controller at each location. Key data points measured to evaluate refrigerant levels included:

- Ambient temperatures
- Liquid refrigerant levels
- Discharge pressures
- Times of day

Using this time-based data to analyze equipment performance, smart fault detection algorithms in Emerson's remote leak detection system established models that depicted normal liquid refrigerant levels in various operating conditions. Data and refrigerant level models were then consolidated and processed through Emerson's ProAct™ Services using cloud-based data analysis.

When the system detected a deviation in refrigerant level from an expected level for the given operating conditions, it generated an advisory notification reporting on the anomaly. Depending on the degree of deviation, the system issued a warning or alarm to Emerson's ProAct Service center. There, a team of experienced refrigeration experts remotely performed triage to prioritize the advisory. Then, the system notified the appropriate parties in the retailer's stores, providing additional information on the equipment, its operating condition, location and potential resolution steps. Critical situations that required immediate attention were routed directly to the chain's contractor crews to perform on-site validation and necessary repairs.

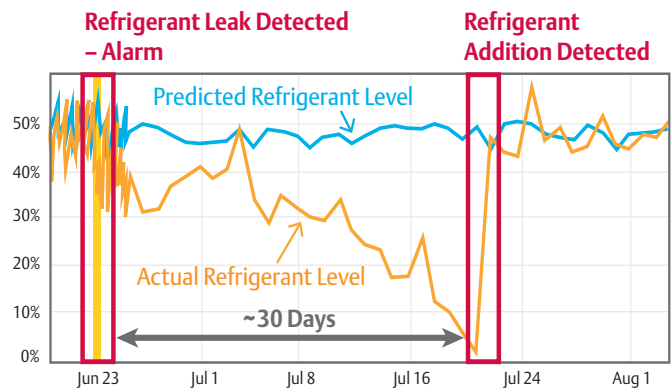
Pilot program results

After one year of participating in the Emerson remote leak detection program, the supermarket chain had reduced its refrigerant leaks by 25 percent, dropping its overall refrigeration leak rate to less than half of the industry average.

With each store's refrigeration system averaging approximately 2,000 pounds of refrigerant charge, this 25 percent reduction in leaks equated to \$560 savings annually in reclaimed refrigerant per store, totaling \$56,000 annually for the 100-store network included in the pilot. Overall, the chain calculated it would achieve payback on its investment in significantly less than 24 months — the financial benchmark established for the program's success.

An unexpected benefit of Emerson's leak detection program was the discovery that the chain's existing refrigerant levels were marginally low, causing refrigeration units to work harder and longer, creating unnecessary wear and tear and consuming more energy. By adjusting refrigerants to optimum levels, the retailer was able to improve overall refrigeration performance, better manage safe food temperatures, and likely achieve marginal reductions in energy consumption.

Upon completion of Emerson's remote leak detection pilot,



Remote leak detection is capable of detecting leaks 30 days prior to traditional "sniffing" methods.

the supermarket chain was convinced of the program's operational, financial and sustainability benefits. The retailer elected to expand the service beyond its network of 100 stores. 🌍

The true cost of refrigerant leaks

Remote leak detection can identify small leaks much earlier than other methods, sometimes as much as 30 days sooner than "sniffing" technologies. That's important because every additional day of refrigerant leakage contributes to negative environmental impacts, higher risk of large repair costs, potential food safety issues and food loss, and shopper dissatisfaction. Consider the following scenario based on the EPA's GreenChill¹ research of industry averages:

- The average supermarket loses 25 percent of its annual refrigerant charge to leaks.
- With an average refrigerant charge of 3,500 pounds, this leakage equates to 875 pounds of lost refrigerant per year.
- At the cost of approximately \$7 per pound of refrigerant, one supermarket stands to lose \$6,125 annually to refrigerant leaks.
- If this supermarket is one of 100 stores in a larger network, the chain could potentially lose more than \$600,000 annually.
- Using R-404A as the refrigerant, the carbon dioxide equivalent (CO₂eq) of this leak level is 3,431,400 pounds annually per store.

1. https://www.epa.gov/sites/production/files/documents/gc_averagestoreprofile_final_june_2011_revised_1.pdf

