FIELD CASE STUDY — AI REFRIGERATION LEAK DETECTION

The Invisible, Perpetual Leak

How continuous leak analysis ended a multi-year refrigerant loss at a high-volume supermarket distribution warehouse

3 yrs	$174K	≈1,240 t	$58K/yr
the leak ran undetected, logged as a new event each time	refrigerant & service spent over those 3 years before the fix	greenhouse gas (CO_2e) stopped per year — about 270 cars off the road	recurring spend eliminated by one repair

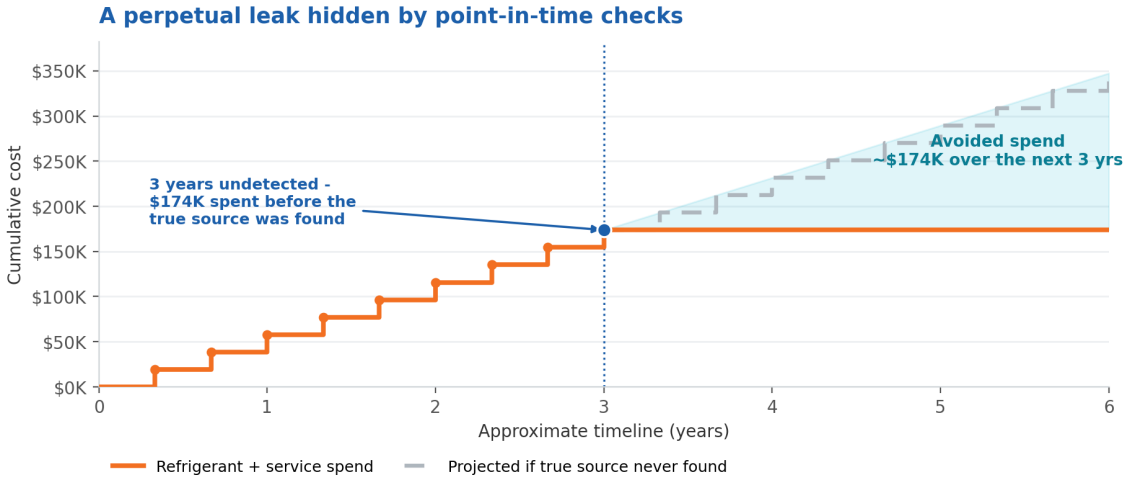
In commercial refrigeration, the costly leaks are rarely the dramatic ones. They are the slow, hidden losses that pass every routine inspection — the rack that tests leak-free yet bleeds charge for years. This is one such case at a high-volume supermarket distribution warehouse, where KalderIQ — Kalder's AI refrigeration monitoring system — isolated a recurring loss that years of inspections had missed, one quietly costing tens of thousands of dollars and venting more than a thousand metric tons of greenhouse gas (GHG) every year. KalderIQ flagged it within two weeks of going live in early 2025.

A leak that kept coming back

The site runs large medium- and low-temperature refrigeration racks. The rack in question holds a full charge near 1,200 pounds of R-407F. For years it followed one pattern: every three to six months its charge fell far enough to hurt performance, a technician was dispatched, a small leak was found and repaired, and 400 to 600 pounds of refrigerant were added to bring it back to full.

Every visit looked like a success — a small leak found, the rack recharged and running cold again. But on a system with miles of piping, finding a leak is not the same as finding the leak. Each call turned up a minor, incidental leak; the true source was never located. A standard leak check is only a snapshot — it catches whatever registers that day, and with no one trending the system over time, every visit was logged as a new, isolated leak.

> **"These were not new leaks every few months. They were incidental finds — patched and recharged — while the real source kept bleeding, unseen by any tool on site."**



Reconstructed cumulative refrigerant and service spend. The orange line steps up with each "find-fix-refill" cycle to the point the true source was found, three years in. The dashed line shows where spend was heading had the source never been found.

What KalderIQ found

KalderIQ monitors the system continuously and trends its behavior, modeling how the charge should hold and flagging the persistent drift a walk-through misses. It identifies an active loss long before the rack runs low enough to trip a conventional alarm.

The warehouse brought KalderIQ online in early 2025. Within two weeks, it flagged this rack as actively leaking while it was still well-charged. A technician was dispatched, found a small leak, repaired it, and closed the call. Days later the trend showed the rack still losing charge; the technician returned and again reported it resolved. When the data flagged it a third time, the call was escalated to a full deep leak check. The source sat on top of a cooler, behind a product box — awkward to reach, easy to walk past, and venting a visible refrigerant cloud. It had been missed on every prior visit for exactly that reason. Once repaired, the recurring top-ups stopped.

The cost: dollars and greenhouse gas

Each find-fix-refill cycle cost close to $19,000 in refrigerant, recovery, and labor. At three cycles a year, that is nearly $58,000 annually — and over the three years the leak ran undetected, more than $170,000 went into a problem that was never fixed. The repair ended that spend outright; this rack has needed no recurring top-ups since. (Unrelated leaks still occur across a site this size — but this one is closed.)

The greenhouse gas (GHG) bill is just as real. R-407F has a global-warming potential of 1,825, so the roughly 1,500 pounds vented each year equals about 1,240 metric tons of CO_2e — the annual emissions of around 270 cars, or 140,000 gallons of gasoline burned. Over the three years it ran, that is roughly 3,700 tons of CO_2e. A GHG loss this size also pushes a large commercial system past the leak-rate thresholds regulators enforce.

The bottom line

Skilled technicians did their jobs correctly every time. What was missing was memory across visits — the ability to connect the repeated small finds to one source no one had located. KalderIQ provided it, and kept pointing back until the true source was found. Without it, this rack would still be leaking today: tens of thousands of dollars and more than a thousand tons of carbon a year, spent on a problem everyone believed was solved.

Estimate basis & assumptions

Figures are estimates for illustration, based on this system's field history: 500 lb R-407F per top-up (observed range 400-600 lb) at $35/lb; ~$1,800 recovery and labor per visit; 3 events/year; 3 years undetected; full charge ~1,200 lb. R-407F GWP ≈ 1,825 (IPCC AR4); CO_2e equivalents per U.S. EPA conversion factors. The customer is described generically to protect confidentiality.