Cold-Chain Project Reveals Temperature Inconsistencies

Deloitte Consulting worked with the University of Arkansas' RFID Research Center to offer Chiquita insight into the temperature history of perishables in transit.

By Mary Catherine O'Connor

Dec. 1, 2006—The introduction of refrigerated cargo containers revolutionized long-distance commerce, enabling the transport of tropical fruit and other goods to Alaska and other distant locations. However, Doug Standley, a senior manager with Deloitte Consulting's technology-innovation practice, believes the means by which companies monitor fresh foods in transit needs to evolve.

Working with Chiquita Brands International and the RFID Research Center at the University of Arkansas, Deloitte initiated a project this year to develop a method for monitoring and controlling the conditions to which fresh or perishable products are exposed while moving through the cold-chain distribution system. RFID is one technology the organizations used to improve visibility into the temperatures inside refrigerated cargo containers.

"Sometimes, a whole load [of perishable goods] is rejected based on a temperature taken at the back of the container," Standley says. "But that's wasteful, because the temperature in the back of the container is likely different than that in the front." At least, that's the theory Deloitte set out to prove. "We said, 'We bet there are microclimates inside the container.' That was the purpose of the pilot: to understand the environment inside the container."

For the tests, the RFID Research Center used KSW Microtec battery-assisted passive RFID tags with integrated temperature sensors. Staff members placed a tag in each pallet containing fresh fruit, and loaded the pallets onto two refrigerated cargo containers. Wired temperature loggers were also installed throughout each load.

Before performing in-transit temperature-tracking, says Bill Hardgrave, director of the center, the staff measured temperatures within zones inside a 40-foot-long refrigerated container at the Research Center, both loaded and unloaded. This allowed them to establish a baseline performance of the container's temperature-control system. . The average temperature in each pallet in the static container, they found, was higher than that to which the container's thermostat had been set, but never by more than 1.3 degrees Celsius.

For the in-transit tests, researchers logged temperatures on the onboard memory of the KSW tags inside a 40-foot container carrying 20 pallets of fruit and a 43-foot container holding 22 pallets. . A handheld interrogator collected the tag data once the containers arrived at their destinations. Compared with the stationary container in the RFID Research Center, the temperatures inside the in-transit containers were higher overall, while the temperature variations within the containers were sizable, based on the location of each pallet in the container.

For example, the two pallets at the back of the 43-foot container were each about 3 degrees warmer than those at the front, closest to the cooling unit. For both containers in transit, most pallets toward the back were warmer than those in the front. Overall, the research confirmed that the temperatures within the container varied by up to 35 percent from pallet to pallet.

Armed with this information, Chiquita and firms selling temperature-sensitive pharmaceuticals and other perishable goods may be able to decrease the rate of waste in the cold chain significantly—which, according to Deloitte, has been estimated to reach 35 percent. The ability to pinpoint those pallets of goods exposed to the highest temps during transit would enable retailers to ensure that merchandise with the shortest expected shelf life was sold first. They could then negotiate with merchants over how much of a container's cargo would be accepted, and how much would be rejected.

Knowing the temperature history of individual pallets of perishable goods would allow merchants to move from a "first in, first out" (FIFO) selling model to a "first to expire, first out" (FEFO) model. Under the latter model, employees would place pallets of produce or other perishable goods that were consistently warmest during transit on shelves first, since those products would have the shortest shelf life. This could translate into better inventory management and product quality.

Hardgrave notes that a company looking to roll out a temperature-tracking system using RFID tags with sensors such as those used in the study would first need to devise a system for collecting and recycling the temperature-tracking tags, due to their high cost—up to $10 apiece. They would also need to calibrate the tags' temperature sensors to take accurate readings in transit.

RELATED_ARTICLES Waheed Zaman, Chiquita's senior vice president of supply chain and procurement, says his firm participated in the study to learn how it might improve the quality and freshness of its products. The company believes that working to optimize cold-chain operations will benefit consumers purchasing its products, as well as the merchants selling them. Chiquita is working with Deloitte to develop its overall RFID strategy, and to comply with Wal-Mart's tagging mandate, which entails having suppliers apply EPC UHF tags to all cases and pallets of goods being shipped. While Wal-Mart does not require its suppliers to track the temperatures of perishable items, the retailer has publicly noted its interest in incorporating temperature tracking into its RFID program.

"We think there is a collision of opportunities vis-à-vis Wal-Mart saying that [it is] interested in tracking temperature and the value that this [temperature information] would give our client," says Standley.