



Minimizing Food Safety Risks From Farm to Fork

*How restaurants and c-stores can deliver safe,
high-quality food offerings*



By Matt Toone
Vice President, Cold Chain Sales
Emerson



Throughout food's journey, operators at each point are now able to monitor, control and track a variety of conditions necessary for preserving food quality.



Americans love to dine out. Every day, more than one-third of us eat at a fast-food restaurant.¹ Over 60 percent of Americans have dinner at a restaurant at least once a week.² And in recent decades, this trend shows no signs of slowing down. At the same time, consumers are becoming increasingly discriminating about what they eat — seeking the freshest, healthiest foods and in greater varieties than ever before.

Whether you're a convenience store operator, quick service retailer (QSR), fast casual or fine dining restaurant, ensuring food quality and safety is imperative to your success. Surprisingly, many consumers and operators alike are unaware of the efforts involved in maintaining safety throughout the food supply chain.

Improvements in refrigeration equipment and the advent of technologies like the internet of things (IoT) are helping to provide more reliable and consistent temperature control within the cold chain. Throughout food's journey, operators at each point are now able to monitor, control and track a variety of conditions necessary for preserving food quality, including: temperature, humidity, the presence of ripening agents, lighting and much more.

As a result, foodservice operators now have an abundance of information with which to validate and help ensure the safety and quality of the food they serve.

Consumer, regulatory expectations raise the stakes

Modern restaurants and c-stores are being held to increasingly higher food safety and quality standards. Consumers and regulators alike are demanding greater transparency in the food supply chain and improved traceability of food's journey from farm to fork. To succeed in this environment, operators must employ the best practices needed to consistently deliver the safe, high-quality food offerings that their customers expect.

Providing consistent food quality is essential to keeping customers coming back. Protecting against foodborne illness outbreaks helps to not only ensure your customers' well-being; it also guards against potentially devastating impacts to your brand's reputation and bottom-line profitability.

But since restaurants are the last stop in the food supply chain, how can operators ensure that food is safe on receipt? And how can they establish and adhere to safe food storage and handling practices in their kitchens?

It starts with understanding everything that contributes to food quality and safety throughout the cold chain. With today's connected IoT monitoring and tracking infrastructures, operators now have better potential visibility into each step of the journey

and even the possibility for comprehensive cold chain traceability. Then, once food has been received and moved into inventory, this process continues by applying all the modern tools available to ensure food quality, safety and consistency all the way to the moment of truth: the point at which it is served to your customers.

Achieving food supply chain safety is cumulative

Regardless of season or geographic location, consumers demand an increasing variety of fresh produce throughout the calendar year. In particular, millennials are keenly aware of what they are

eating and seek high-quality, sometimes exotic food varieties — which may even dictate special handling requirements and potentially increase the possibility of foodborne illness outbreaks.³ It's estimated that nearly half of the fresh fruit and one-third of the fresh vegetables consumed in the United States are sourced from foreign countries.⁴

Achieving this feat can require fresh produce to be transported by land, sea and air in a process that can span the point of harvest, processing, cold storage and distribution — all before it even begins the last-mile delivery to a restaurant. For domestic points of origin, it can take three to four days to transport strawberries from California to the East Coast. Overseas shipments can last

What's putting our food at risk?



When it comes to shipping perishable food items, there are multiple factors that can either decrease its shelf life or increase its risk of becoming unsafe. While maintaining precise temperatures is essential for proper cold chain management, improper handling procedures can be the cause of foodborne illnesses.

Harvest, processing and handling best practices — safe handling practices must guard against:

- The spread of bacterial pathogens that can cause food poisoning, such as E. coli and listeria
- Cross-contamination during shipping, storage and handling
- Poor employee hygiene, unsafe or unsanitary processing methods

Temperature certainty — most of the fresh produce we eat must maintain temperatures continuously from 32 to 39 °F during shipping. Limiting temperature abuse at any stage of the journey is essential to:

- Preventing the growth of bacteria and the potential of a foodborne illness
- Achieving maximum freshness and shelf life

Ideal temperature ranges — stakeholders at every step of food's journey must be aware of the optimal temperature ranges for common fresh produce and other food commodities:

- Bananas — 56 to 62 °F (13.3 to 16.6 °C)
- Tomatoes, yellow onions, potatoes — 42 to 54 °F (5.5 to 12.2 °C)
- General produce — 32 to 39 °F (0 to 3.8 °C). This is the largest category and includes leafy greens, apples, broccoli, carrots, cauliflower, mushrooms, green onions, berries and corn.
- Meat (beef, pork, poultry, seafood) — 28 to 39 °F (-2.2 to 3.8 °C)
- Dairy — 32 to 39 °F (0 to 3.8 °C)
- General frozen foods — -10 to 15 °F (-23.3 to -9.4 °C)

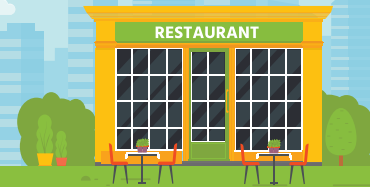
Environmental factors — aside from temperatures, there are other key environmental considerations that must be monitored and managed throughout food's journey. These include:

- Optimizing humidity conditions
- Accelerating or delaying ripening via modifying the atmosphere with ripening agents such as ethylene and CO₂
- Limiting excessive vibration of the shipping container

There are multiple chances for errors in handling along this journey, and foodservice operators can't control them all. But they can start by understanding the steps involved in gaining better visibility into food conditions along the journey.

Cold Chain Safety Is Cumulative

Emerson is involved in every step of food's journey to the restaurant – from the point of harvest, processing, in-transit over land and sea, cold storage, in-store refrigeration and quality assurance.



What's at Stake for Restaurants and C-Stores

FOOD SAFETY IN AMERICA

1 in 6 Americans (48 million people) contract foodborne illnesses each year^A



BRAND REPUTATION IMPACT

A publicized outbreak can severely tarnish a brand's reputation^C

POTENTIAL COSTS OF OUTBREAKS

A restaurant could incur between **\$4,000 to \$2.5 million** for a single outbreak^B

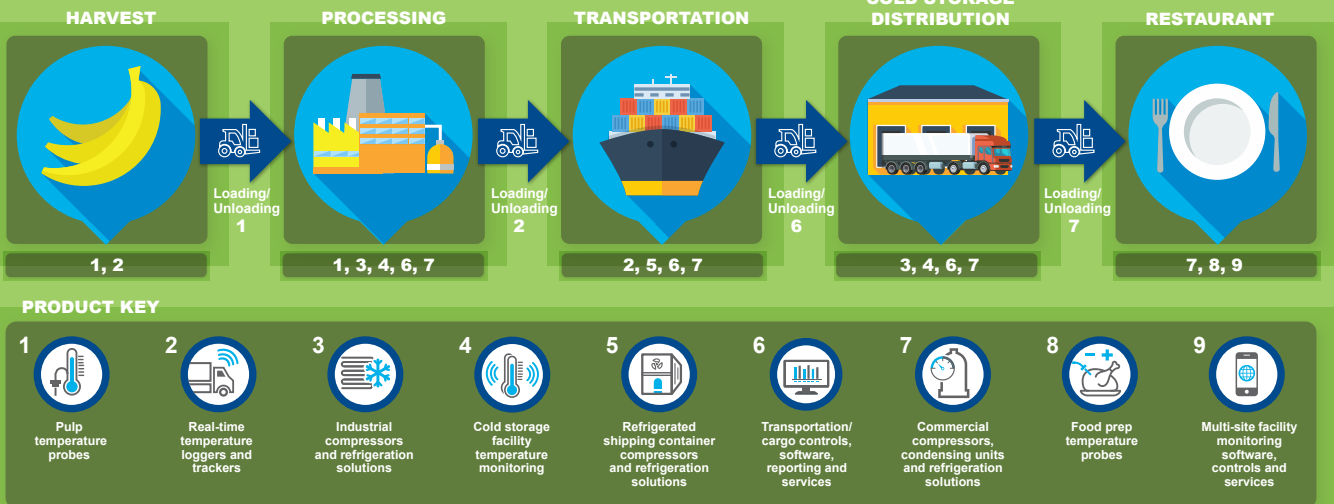


34% of consumers care deeply about the quality of the food they eat^D

44% will avoid the brand for a few months

20% will never return/use the brand again

Helping to Build End-to-end Cold Chain Solutions



A. <https://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html>
 B. <https://www.sciencedaily.com/releases/2018/04/18/180418085910.htm>
 C. <https://www.reuters.com/article/us-chipotle-results-stocks/no-easy-solutions-to-chipotles-public-image-problem-idUSKBN1FR28Q>
 D. <https://cdn2.hubspot.net/hubfs/1668883/Content%20Files%20Downloads/FoodLogIQ%202017%20Transparency%20Survey%20White%20Paper.pdf>
 Emerson provides the products, expertise and resources to collaborate with our customers and help them achieve their cold chain objectives.



anywhere from two to four weeks, whether sourcing bananas from Guatemala or dragon fruit from Vietnam.

It's staggering to realize that there can potentially be as many as 20 to 30 steps and multiple changes of ownership throughout this process. The more these perishable items change hands, or are staged, loaded and unloaded, the greater the chances for contamination and temperature excursions along the way.

Understanding the cold chain journey

Delivering on the promise of consistently safe and exceptional food offerings requires an interdependent supply chain, one that shares the concerns and responsibilities of moving food from the point of harvest to consumers in a safe, consistent and economic way. While the pressure may be felt most at the points where food is sold or consumed, restaurants depend on their cold chain suppliers

to collect, share and report on the handling practices that help keep food safe and fresh throughout its journey from farm to fork.

Harvest and processing

The cold chain journey begins at the moment of harvest. The time of day is among growers' first considerations in preserving produce closest to its desired temperature, but this is also the point at which the decay process can start. For example, strawberries picked during the heat of the afternoon can respire and radiate heat — both of which can adversely affect product shelf life and quality, especially considering that this is only the first step of a long and complex journey.

Processors attempt to halt the decay process by controlling temperatures and the produce's transient environment post-harvest. They may opt for a flash-cooling/freezing process or

move the product into a temporary storage cooler until loading. Pre-cooled shipping containers help to remove excess field heat and may also be injected with a ripening or delayed ripening agent if modified atmosphere is needed. Processors can also measure ethylene gas levels, since it is a natural off-gas that is produced and can accelerate the ripening process.

Cold chain solutions: Temperature recording starts with probing devices that take internal “pulp” temperatures prior to and during the staging and loading processes; temperature monitoring and tracking begin with the activation of devices inside the shipping container. And so begins the continuous data collection as the container progresses to the next step of its cold chain journey.

Transport

Depending on the distance between the point of origin and the next destination, the transportation portion of food’s journey



Navigating the regulatory landscape

Food safety regulatory compliance is more important — and more complicated — than ever. For foodservice operators, the regulatory focus is shifting from reactive measures to proactive prevention. To ensure compliance, operators must collect and maintain certain up-to-date documentation of their food safety plans. In addition, maintaining traceability is essential to implementing effective recall programs.

The Food Safety Modernization Act (FSMA) of 2011 gives the Food and Drug Administration (FDA) legislative authority to mandate comprehensive, science-based and preventative controls governing the safe storage, handling and preparation of food throughout the supply chain and in restaurants. FSMA rules that incorporate cold chain concepts include:

- **Foreign Supplier Verification Program (FSVP)** — mandates that food processed abroad and imported into the U.S. for commerce be treated as if it was produced in the U.S. This helps create the expectation of proper cold chain management.
- **Sanitary Transport of Human and Animal Food** — ensures that shipping containers are properly sanitized, and temperatures maintained according to the requirements of the commodity shipped.

- **Preventative Controls for Human Food and Animal Feed** — modernizes requirements for current good manufacturing practices (cGMPs) for domestic and foreign facilities by establishing and implementing hazard analysis and risk-based preventive controls. A primary preventative control is ensuring that food is processed and stored at proper temperatures.

To help operators create their own best practices and comply with FSMA rules, the FDA recommends following the globally recognized methodologies for food safety and prevention:⁵

- **HACCP (Hazard Analysis and Critical Control Points)** — global standard established to help operators develop food safety documentation plans designed to prevent, eliminate or reduce the food safety hazards to acceptable or safe levels.
- **HARPC (Hazard Analysis and Risk-based Preventive Controls)** — update to HACCP that requires operators to identify potential hazards and implement controls to minimize their occurrences through active, continuous monitoring of temperatures, record keeping and documentation.

Note: The FDA has the authority to mandate recalls if companies refuse to conduct their own voluntary recalls. Typically, this mandate is not needed, since most companies voluntarily comply.⁶



can take anywhere from days to weeks — by truck, sea and/or air. There, transport companies attempt to maintain an unbroken chain of temperature certainty and product quality by following a variety of best practices.

During the loading process, pallets are often stacked to promote airflow and then “load locked” into place to prevent shifting and limit excessive vibration during transport. Shipping trucks and containers are equipped with the most reliable, field-tested compression technology that’s able to withstand excess vibration while ensuring that the transport refrigeration systems preserve product at desired temperature ranges. Mixed-load cargos require multiple refrigeration systems to maintain storage temperatures at different ranges within the same shipment.

Cold chain solutions: Independent temperature monitoring, logging and tracking devices provide real-time communications to shipment stakeholders regarding temperature and location conditions of product in-transit. These systems enable remote monitoring and issue alert notifications when there are deviations in temperatures, humidity, modified atmosphere settings and vibration.

Cold storage distribution center

Upon receipt at a cold storage facility, handlers should inspect the product’s condition by checking the pulp temperature with a probing device and verifying temperature data from the logging device. There, HARPC/HACCP plans should confirm temperature at receipt and prior to unloading at each delivery and distribution point. It is important to remember that simply checking the ambient

air of the refrigerated shipping container is not enough. Some carriers have been reported to turn off refrigeration during long journeys to save fuel, and then turn them back on in time to pull down temperatures prior to arrival at their destination.

The next step is to transfer product into cold storage as soon as possible. Many of these facilities have established multiple temperature zones for various perishable items and use a combination of industrial and commercial refrigeration technologies.

Cold chain solutions: These facility operators should also maintain the unbroken chain of temperature certainty with devices that monitor, record and maintain proper temperatures. They also must maintain the desired produce ripeness at specific points in its journey to the consumer, including sometimes utilizing modified atmospheres and monitoring ethylene production to accelerate or delay ripening, as needed. From cold storage, produce is distributed to its final destination at the restaurant.

Best practices in the store and across the enterprise

The moment a shipment is unloaded at a restaurant is the point at which foodservice operators can begin to assert their own controls over food safety and quality. Like the receiving process at the cold storage facility, this starts by checking pulp temperatures and data logs throughout the shipment’s journey per documented HARPC food safety plans.

There can be numerous opportunities for errors during the receiving processes — most notably, leaving the shipment exposed to high ambient temperatures for too long. Thus, transferring

perishable product into cold storage coolers and freezers as quickly as possible is imperative. A HARPC plan should also document the refrigeration requirements of fresh and frozen foods, making reliable kitchen refrigeration the foundation for safety and quality once items arrive at a restaurant.

Cold chain solutions: Modern advances in facility and refrigeration controls can help operators maintain proper temperatures, comply with food safety regulations, and streamline the management of restaurant operations in individual stores and across multi-site networks. These advanced systems provide real-time access to the critical information retailers need to immediately track, triage and quickly respond to issues related to food safety and quality. Continuous 24x7, automated temperature monitoring and recording devices help operators:

- Eliminate the need for time-consuming manual documentation
- Access on-demand reporting as needed for food safety compliance purposes
- Provide historical cold chain data

Of course, food safety plans should also include processes for monitoring the hot side of the kitchen and food preparation activities. There, temperature-probing devices automate the recording of prepared food temperatures to maintain HARPC

compliance and verify safety. These devices also help to ensure consistent food preparation and a positive customer experience, while removing the potential for manual recording inaccuracies.

Together, these cold- and hot-side practices help to ensure food safety process compliance in individual restaurants and across the enterprise.

Putting food safety within reach

Today, leading retailers who are most concerned about food safety and their brand reputations are adopting these cold chain technologies as best practices. At Emerson, we have both the refrigeration expertise and targeted solutions for nearly every point along the food supply chain. Our growing portfolio of connected, communicating devices and enterprise management software provides the solutions and resources to help our customers achieve cold chain temperature certainty and verification throughout food's journey.

From compression and refrigeration system technologies, to case controls and facility management devices, to temperature loggers, trackers and probing devices, to software and services — we're a leading single-source partner dedicated to helping our customers ensure full cold chain integrity.

Cited sources:

1. <https://www.forbes.com/sites/garystern/2018/10/25/a-third-of-americans-dine-out-nightly-at-fast-food-restaurants-a-nutritionist-speaks-out/#2ba250ce7fee>
2. <https://news.gallup.com/poll/201710/americans-dining-frequency-little-changed-2008.aspx>
3. <https://www.tracegains.com/blog/millennials-are-changing-the-food-industry-what-this-means-for-food-manufacturers>
4. <https://www.nytimes.com/2018/03/13/dining/fruit-vegetables-imports.html>
5. <https://www.foodsafetymagazine.com/enewsletter/haccp-vs-harpc-a-comparison>
6. <https://www.feedstuffs.com/commentary/mandatory-vs-voluntary-recalls-and-fsma>