

WHITE PAPER

10 Best Practices in Cold Chain Management



The Heat is on Like Never Before

For shipping and logistics managers tasked with cold chain management, the heat is on like never before.

Overcoming the challenges inherent with any supply chain — increasing customer demand and the never-ending push from the C-suite to drive down costs and increase efficiency despite resource and capacity constraints — is enough to test anyone's mettle. As someone entrusted with packing and distributing temperature-sensitive foods and medicines the world depends on, you face even more pressure due to stringent temperature requirements, evolving regulations, and increasing scrutiny from regulatory agencies.

The global cold chain logistics market began climbing steadily in recent years to meet the world's growing demand for fresh foods and medicines, and is **expected to top \$410 billion annually by 2028** — a 65% increase since the onset of the pandemic.

Meeting this need for transporting perishable goods safely and efficiently requires consistent investment in tracking technology and cold chain infrastructure. Strategic partnerships can play an integral part in cold chain management to help maximize that investment.

In this white paper, we take a closer look at cold chain management, why it's important, and the processes involved in ensuring [efficient operations](#) in industries that rely heavily on an uninterrupted cold chain. We also present several challenges facing cold supply chains and offer 10 best practices to overcome them.



What is Cold Chain Management?

Cold chain management, as the name suggests, involves overseeing supply chain operations that **preserve and protect temperature-sensitive food and medical products.**

As a leader in this position, you need to be aware of the shipping environment, package design, and shipment details—such as the length of trip and the acceptable temperature range for each product. Cold chain management also includes documentation review, training, transparent communication, and end-to-end visibility that provides insights and keeps you in control throughout the supply chain journey.

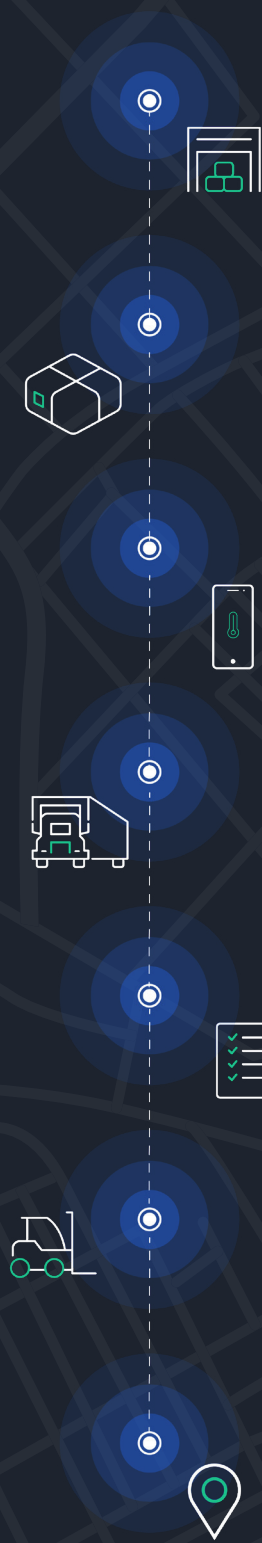
Why is Cold Chain Management Important?

First and foremost, cold chain management and logistics help protect the safety, integrity, and quality of perishable foods and temperature-sensitive medical products. No retailer in their right mind would accept a load of [fresh organic blueberries](#) that are frostbitten or a shipment of chicken that arrives at room temperature. In-transit temperature variations can also ruin the efficacy of medicines. Robust cold chain logistics also reduce waste and ensure supply chain efficiency. Delivering time-sensitive products on time, in full, and of the highest quality drives customer satisfaction to new heights.

Achieving those goals requires strong leadership, collaborative partnerships, a documented cold chain process, and robust temperature-tracking technologies. Data from cloud-based loggers and temperature trackers assure stakeholders of the latest shipment status—and provides a documented audit trail that helps demonstrate uninterrupted [cold chain custody](#) to the U.S. Food and Drug Administration, the Centers for Disease Control, the World Health Organization, and other global regulatory agencies.



The Cold Chain Management Process



Storage: Even before the first-mile journey begins, temperature-sensitive products and perishable foods must be placed in cold storage at the point of origin. In some cases, cold rooms, chillers, and freezers will suffice. Vaccines and biologics may require special medical refrigerators or freezers. Cold chain storage equipment and facilities must be calibrated and monitored to ensure proper temperature ranges.

Packaging: Warehouse personnel must package products properly to ensure they can be transported long distances without damaging the appearance, flavor, or quality. This cold packaging can take many forms: from envelopes and insulated coolers to cold chain parcels and pallet systems that use a combination of refrigerant bricks, gel packs, and gel bottles.

Tracking: Maintaining tight oversight of perishable shipments—once they leave temperature-controlled storage environments—is crucial. Savvy logistics professionals rely on technology, such as cloud-based temperature loggers and real-time hyper-accurate trackers. Applied at the shipment or container level, this technology detects excursions at the moment they occur—and alerts the shipper, broker, and carrier.

Transportation: Shippers have various specialized transportation options for moving temperature-sensitive goods and products around the globe. Refrigerated vehicles (“reefers”) and reefer containers are commonly used for ground transportation. Effective cold chain management includes shippers verifying that the reefer temperatures match the requirements listed on the bill of lading.

Customs Clearance: Cross-border shipments bring customs clearance into play. Whether it’s a load of avocados from Mexico bound for the U.S. or COVID vaccines for global distribution, shippers must ensure customs paperwork is complete and accurate to ensure quick and efficient deliveries. Failure to do so can result in delays, increasing the risk of spoilage, product loss, or additional expenses.

Product Management: In addition to the specialized packaging mentioned above, cold chain management also includes ensuring that warehouse workers are fully trained in best practices for handling both temperature-sensitive products and the equipment used to load/unload shipments. Doing so will help eliminate the risk of cross-contamination and limit out-of-refrigeration time.

Tracking: Whether going across town, coast to coast, or around the world, the ultimate goal is to complete deliveries of temperature-sensitive products on time and in full. Data loggers and trackers stay with the products and provide visibility through final delivery—creating an audit trail that confirms cold chain custody remained intact throughout the supply chain journey.



What Industries Focus on Cold Chain Management?



Food & Beverages: Feeding the World's Appetite for All Things Fresh

Companies that ship perishable commodities such as meat, dairy products, fresh produce, or frozen products rely on [temperature loggers](#) to maintain cold chain custody from the point of origin to final-mile delivery. Any temperature excursion outside of product-specific ranges might make the load unsellable. As much as [75%](#) of the 1.6 million tons of wasted food globally can be attributed to cold chain failures during production and distribution. Worse still, unsafe food that finds its way into consumers' hands causes 600 million cases of foodborne diseases and 420,000 deaths annually, according to the World Health Organization.



Pharma: Safeguarding Health with Medicines & Vaccines

Pharma is another industry plagued by waste: an estimated \$37 billion in medicines are lost every year due to failures in cold chain logistics alone, according to the IQVIA Institute for Human Data Science. Depending on the medicine, pharma can ship at temperatures ranging from ambient (+15°C to 25°C), refrigerated (+2°C to -20°C), or frozen (below -20°C). Any excursion beyond those acceptable ranges could result in millions of dollars in losses. Conversely, the right visibility solution can provide in-transit alerts that can help save pharma shipments. Here is a [case study](#) that illustrates both outcomes.



Life Sciences: Research & Development that Impacts Lives

The Life Sciences industry expands beyond pharmaceuticals to include the research and development of cell and gene therapies, biotechnology-based foods and medicines, medical devices, biomedical technologies, nutraceuticals (nutritional supplements, vitamins, etc.), and cosmeceuticals (cosmetics that have or claim to have medicinal properties). Many of these products contain active pharmaceutical ingredients that must be stored at specific temperature ranges. An excursion beyond those limits could ruin the quality of those products.

Without a robust cold chain management structure, these sectors will struggle due to errors and delays, poor accountability, and decreased regulatory compliance — all of which could result in lost revenue, or an inability to protect consumers.

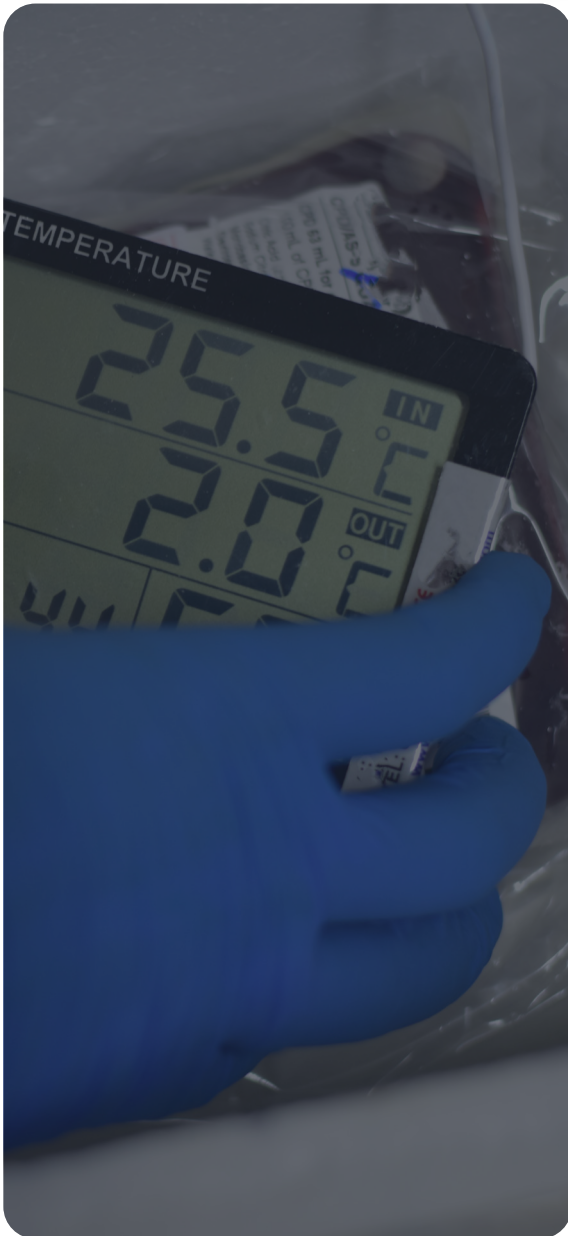


Challenges in Cold Chain Management

Any supply chain encounters numerous challenges, but cold storage management requires diligence in guarding against temperature excursions that could carry **severe safety or financial consequences**.

Following are some common cold chain challenges:

- **Excessive heat exposure:** Each temperature-sensitive product becomes vulnerable to degradation when removed from a refrigerator or freezer unit. Loading, unloading, and product transfers in a cross-docking or other freight consolidation situation often leave such products at risk for exposure to higher temperatures. Exceeding the maximum time out of refrigeration can ruin products.
- **Damaged products:** Improper handling during loading or unloading can lead to damaged products, but so can the trip itself. For example, vials of vaccines not correctly packaged are susceptible to breakage during shock events and other movements while in transit.
- **Faulty equipment:** Forklifts can inadvertently damage freezer doors during loading and unloading, rendering them unable to seal properly and maintain acceptable temperature ranges.
- **Excessive condensation:** Much like an ice-cold pitcher of lemonade sitting on a picnic table under the hot summer sun generates moisture, condensation can form on temperature-controlled products moved from one temperature to another too often or too quickly. In such cases, product adulteration can create a health risk for consumers.
- **Mold and mildew in the cooling units:** A broken seal on refrigeration equipment or freezer could lead to mismanaged temperatures, resulting in microbial contamination of the goods inside.



10 Best Practices in Cold Chain Management



1 Choose the right transportation partners: Ocean and rail can be cost effective for long shipments, but might not be best if deadlines are tight. Air cargo might be the best choice for time-sensitive medical shipments or high-priced commodities with a shorter shelf life—but comes at a higher cost, and maintaining temperature could be a challenge. Road freight provides route flexibility, but finding capacity could be difficult. Regardless of the mode, it's best to select carriers with experience in moving temperature-sensitive products.



2 Adopt robust tracking technology: Your control over shipments doesn't have to end when a shipment leaves a cold storage warehouse. A cloud-based solution featuring data loggers and hyper-accurate temperature trackers begins to record temperature data the moment trackers are activated, and won't stop until final delivery. This technology provides full transparency through track-and-trace capabilities, with configurable alerts that notify stakeholders of excursions.



3 Set clear expectations early in the process: To reduce risk, all stakeholders should be aware of each shipment's contents and temperature ranges, and be involved in defining roles, expectations, and requirements.



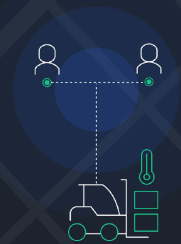
4 Establish standard operating procedures: Provide employees and stakeholders with simple, thorough instructions for cold chain processes. Proper packaging techniques, loading and unloading instructions, equipment handling procedures, and how to handle temperature are a few topics your plan should cover.





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Train and protect employees: Ensure all employees have adequate knowledge of the temperature requirements of each product handled during packaging, loading, and unloading—and how to clean and sanitize work areas to prevent cross contamination. Employers should also provide coats, insulated pants, gloves, and other personal equipment necessary for completing tasks safely.



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Shippers and carriers share responsibility when loading and unloading: Temperatures inside the vehicle/container and in the dock area must be monitored and maintained to ensure product quality. Consider, too, the time necessary to load and unload; the longer an item sits outside a temperature-controlled environment, the greater the risk for spoilage.



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Maintain temperature records: Temperature sensors in the warehouse—and on each in-transit shipment—automatically collect data and trigger alarms when excursions occur. Collecting this information electronically saves time and money. It also reduces errors while assuring receivers and regulatory agencies that cold chain custody was not interrupted during the supply chain journey.



8

Use suitable equipment: Seal hand-held equipment and electric forklifts to ward off condensation, which is a threat in cold storage warehouses when moving from lower to higher temperatures.



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Collaborate... and when in doubt, collaborate more: Ensure all stakeholders have access to location and temperature data related to cold chain shipments, and that they can receive status alerts — all from a “single source of truth” cloud-based solution.



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Be ready for the unexpected: Even the most thought out cold chain management plans can go awry when an unexpected disruption occurs, such as a weather event, port congestion, or flight cancellation. Thanks to in-transit visibility solutions, you and other stakeholders will have the data insight needed to make informed decisions that will help mitigate the impact—and save temperature-sensitive shipments.



Europe: A Hot Market for Cold Storage

Cold storage has been on the rise in Europe since COVID reached pandemic status in early 2020.

A shortage of drivers, border closures, and strict quarantines forced companies to shift focus to place a greater emphasis on cold storage to extend the shelf life of temperature-sensitive products. Even as the pandemic subsides, the demand for cold storage continues to rise.

The cold chain market in Europe could reach **\$330.2 billion by 2030.**

[Precedence Research](#)

The drivers of such market growth include free trade agreements between European Union member nations and trade agreements with countries outside the EU, the exponential growth of e-commerce and the rise of direct-to-consumer shipping, and the age-old forces of supply and demand. Consumers want fresh food and drinks. Retailers need to extend product shelf life and ensure top quality. These are the catalysts prompting manufacturers and retailers to invest more in cold chain equipment—and forge strategic relationships that provide cold chain integrity and visibility, from the point of origin through the final mile.





The Right Tech Partner Can Help You Handle the Heat of Cold Chain Management

Cold chain management doesn't just happen. It takes a dedicated team and collaborative supply chain partnerships who believe every shipment matters. It's impossible to approach it any other way when you're moving what arguably could be considered the most essential products the world relies on today — temperature-sensitive perishable foods, medicines, and medical products. The world's demand for those items increases by the day.

We would love to have a deeper discussion with you about how Tive's industry-leading, hyper-accurate trackers—and new Tive Tag temperature data loggers—can help provide the end-to-end cold chain visibility needed to ensure on-time, in-full shipments. Let's start with a demo today.



[Schedule a short discovery call](#) with our team of experts to get started.