

from **FARM** *to* **FORK**

the complete guide to monitoring for food safety



temperature@lert

From Farm To Fork

a guide to monitoring for food safety

Temperature@lert
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About the Author

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Introduction



Imagine yourself as the General Manager Boston's hottest new restaurant and the grand opening is just hours away. Online reviews are raving in anticipation about this must-try, fine-dining establishment that specializes in preparing steak and seafood dishes from around the world. Your menu features dishes whose descriptions that would make any mouth water– lobster from Maine, oysters from the Pacific Northwest, seabass from Chile, and Kobe steak filets from Japan. Oh yes, and don't forget about the obligatory bottles of bubbles from France that oysters and lobster require. These are plates that will most likely cost a better portion of your customers monthly rent check, but, luckily for you, they're more than willing to splurge on a couple of dishes, that supposedly, are to be the best they've ever tasted.

For the opening of the restaurant, you've made sure to order plenty of product, to cover all the heads that will be dining with you that evening. Delicacy ingredients are shipped from all corners of the globe – flash frozen or ice-packed, and delivered to the kitchens so that they can be prepared for the full dining room of hungry guests.

“In the United States, food travels an average of 1,300 miles to reach you”

-National Sustainable Agricultural Information Service (2014)

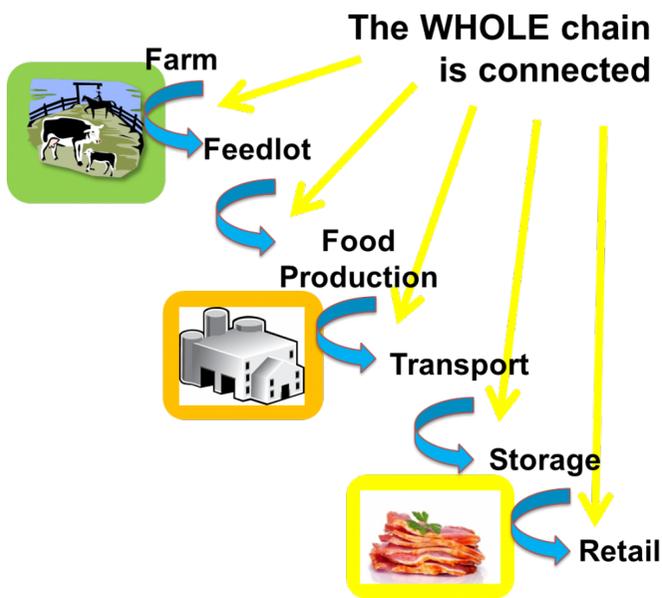
As a manager, you want to be able to guarantee that the ingredients in the dishes you are about to serve to your diners were transported, stored and prepared safely given the price of the dishes, the luxurious atmosphere of the restaurant and the standard for impeccable service. You have a reputation to uphold as one of the premier dining establishments in town, but you also don't want to be responsible for a single outbreak of food poisoning. But, as you open that case of oysters that was delivered to your restaurant that morning, a quick “olfactory inspection” tells you everything you need to know. Turns out that those oysters are anything but fresh or edible, unless you want your diners to contract the worst case of food poisoning imaginable. Somewhere along the 3,000 mile journey across the country to your kitchen, those oysters became too warm and they spoiled.

Doesn't that sound delicious? Didn't think so.

Unfortunately, the whole shipment of shellfish is completely trashed and cannot be served. Such a disappointment for the restaurant that was supposed to be the best new place in town for fresh seafood and for the customers that had been dreaming of oysters since they made their reservations. It's the first night of service, and already the restaurant is out hundred of dollars worth of shellfish that spoiled on route.



The color changing strips, that were packaged with the ice-packed oysters to indicate if the seafood had been out of the proper temperature range for any period of time, have indicated that somewhere along the journey to the restaurant's kitchen, something went wrong. Although it's not necessarily your fault that the oysters were spoiled, but as the manager, boxes of spoiled shellfish are now your problem to deal with. Unfortunately, it's an all-too-common scenario that impacts thousands of businesses and consumers worldwide.



By relying on the color changing strips, a form of temperature monitoring that is informative and helpful only *after* damage has been done, there is no time to prevent problems, but rather only time to clean up the mess that has been left. Even when temperature monitoring products like these color changing strips perform optimally, their outdated technologies or inadequate “contingency features” often fail to alert their customers to environmental problems fast enough to save food product before it's too late.

Although you might not realize it, temperature is an extremely critical aspect of day-to-day operations in food service. When temperatures stay within a certain range, the people, processes, and products of the industry can function seamlessly. However, when temperatures fall out of

that range, you better believe that bad things can happen within just a few hours, or even minutes! What kind of bad things, you ask? How about a plate of spoiled oysters, for example.

Every year, temperature fluctuations, at all stages of the cold chain, from production to transport, cost the food service industry hundreds of thousands of dollars in spoiled or compromised product. But, still, that isn't the only consequence. In addition, food service industry workers, from distributors to resellers, can find themselves on the losing end of costly legal battles, civil and criminal, if they fail to comply with industry or government-mandated temperature rules or guidelines.

Worldwide, refrigerated foods are one of the fastest growing segments for food service and food distribution companies. Because accidents and mishandling can easily lead to contamination or spoilage of perishable food items, it's critical to monitor temperatures at every stage of the cold chain to ensure food safety and to prevent customer sanctions and consumer litigations.

In this book, we'll explore how you can guarantee the health and safety of your food products that should always be maintained at proper temperatures from farm-to-fork. We'll show you how automated, continuous temperature monitoring devices can track each stage of your food products so that if they ever fall out of range of safe temperature you'll be able to take preventative action rather than have to clean up a costly disaster.

It might sound a little bit obvious, but the truth is that refrigeration and temperature control is key in preventing spoilage and bacterial growth in perishable food items. Whether you are talking about fresh produce, seafood and shellfish, dairy or meat products, maintaining cold storage and proper temperatures is essential in ensuring public food safety. And this isn't just for food that has been processed, packaged, and ready-to-eat. Actually, you may, or may not, be surprised to learn that a temperature-controlled supply chain, otherwise known as a cold chain, matters at every stage of food production – from farm to fork.

Chapter 1: Harvesting





Did you know that temperature monitoring for chickens begins at incubation of the egg? Fall out of range of proper temperature thresholds at any point during a chicken eggs development, and you can bet that not only will your attempts at achieving maximum hatchability be greatly affected, but also severe temperature fluctuations will cause higher early embryonic mortality, exploding eggs, poorer quality chickens, and infected day-old chicks, which also leads to increased first-week mortality rates. So, as you can see, temperature matters big time, even before the eggs hatch and mature into chickens. True, temperatures during this stage of production are not necessarily cold, as the "cold chain" name suggests, but they're still mighty sensitive to temperature fluctuations nonetheless.

Or how about maintaining proper water temperatures for fish at fish farms? Did you know that after oxygen, water temperature is the single most important factor affecting the welfare of fish? Fish are cold-blooded organisms that assume approximately the same temperature of their surroundings so the temperature of the water they are swimming in affects the activity, behavior, feeding, growth and reproduction rates. Unregulated water temperatures can adversely affect fish by slowing down the development of their eggs, reducing the growth of juveniles and older fish, delaying and even preventing maturation and spawning, decreasing their food intake and even stopping it completely and increasing their susceptibility to infections and diseases. Knowledgeable fish farmers understand very well that temperature control is vital in guaranteeing not only the health, but also, the volume of their product.

"About 1 in 6 Americans get sick each year from foodborne diseases"

-Centers for Disease Control and Prevention (2014)

How about those people that don't eat meat and fish? If you guessed that it's equally important to monitor temperature for fruits and vegetables that it is for meat, then you guessed right! Although the preliminary stages of produce production are less focused on maintaining proper temperatures and more focused on crop yield, observing proper temperatures is critical for farmers that are trying to achieve maximum growth rates, and in turn, maximize profits. If you're trying to maximize the yield of your crop, making sure to maintain a specific range of temperatures is vital. Too cold and crops may germinate unevenly or not at all. Too hot and you could kill your seeds before they even have a chance to grow at all.

From profit losses to potential food-borne illness to spoilage to product yield, the people who work in the growth and production stages of the food industry understand very well the consequences that can come from not adhering to proper temperature standards. Temperature monitoring is essential in maintaining the quality and safety of refrigerated foods throughout the food continuum, starting at the place of origin, whether those foods be meat or produce.

Summary and Key Points:

1. Whether you are talking about fresh produce, seafood and shellfish, dairy or meat products, maintaining cold storage and proper temperatures is essential in ensuring public food safety.
2. Temperature monitoring is essential in maintaining the quality and safety of refrigerated foods throughout the food continuum, starting at the place of origin.
3. A temperature-controlled supply chain, otherwise known as a cold chain, matters at every stage of food production.

Chapter 2: Processing & Packaging



When the chicken eggs have finally hatched, the fish in the pond have fully matured, and the crops in the field are ready to harvest; your food continues on its journey from farm to fork. Temperature, as you've probably already guessed, only becomes more important to the health, safety and quality of your favorite perishable foods during this journey.

Let's call the next point in the food continuum the processing stage. It's during this stage that food from the farm undergoes a series of cleaning, treatments, and preparations that make the food safe for consumption before it can be transported to restaurants and grocery stores. Of course, there are different processes for different kinds of foods, but whether it be a harvested crop or a harvested protein, the processing stage is one that cannot be skipped because without it, the annual number of foodborne illness cases would be exponentially higher. Overall, the consensus is that temperatures of 41° F or below prevent the growth of pathogens in perishable food items, so creating a cold processing environment in which temperature is carefully monitored is crucial in maintaining the health and quality of food products.



For instance, at the poultry processing plant, once the chickens have been scalded and de-feathered, they are taken to a room that is chilled to 40° F. This is an extremely important stage in the processing of the poultry product because if the scalded and cleaned chickens do not get into rooms at colder temperatures within four hours of their slaughter, they are much more likely to contract bacterial diseases and microbial spoilage. The rapid chilling of the chicken not only limits the growth of pathogenic bacteria on the poultry, but also, increases the chicken products' shelf-life dramatically.

Once the chickens have been properly chilled, they are ready for packaging. At this point, according to USDA regulations, not only must the packing room maintain temperatures of 40° F or less, but also, the internal temperature of the chickens must also be at a temperature of 40° F or less. Cool temperatures must be maintained throughout the processing and storage stages, because if the poultry product ever becomes warm, it falls into a danger zone in which it could become infected with dangerous bacterium. In fact, did you know that during this stage of the poultry processing that the meat is most likely to contract salmonella? Yikes!

Along the lines of seafood, which is especially prone to bacterial infection and is extremely sensitive to temperature variations, cold storage is key. When talking about fish processing, the term refers to the processes associated with fish and fish products between the time the fish are caught or harvested to the time that the final product is delivered to the customer. Fish are highly perishable and a central concern of fish processing is to prevent them from deteriorating, spoiling, and contracting bacterial infection. Where poultry needs to be kept at temperatures of 40° F at its comparable stage, fish needs to be kept at much colder temperatures. Fish kept at 32°F, the temperature of melting ice, will keep in better condition and stay fresher longer than fish kept at higher temperatures. In as little as 20 minutes, every increase of a degree of temperature above 32° F will lead to more rapid microbial growth, resulting in shorter shelf life. Even slight variations from proper storage temperature can result in shorter shelf life. For example, the shelf life of cod fillets at 32° F has been estimated 10-12 days, 5-6 days at 40° and only 2-3 days at 50° F.

It's true that chicken is the most widely consumed protein, and that seafood dishes are becoming more popular options for consumers, but proteins aren't the only popular perishable foods that need your temperature

attention during the processing stage. We, as a society, may love meat, but we love our fruits and vegetables too. Did you know that, according to industry experts, fresh-cut lettuce and leafy greens have reached \$3 billion in sales annually? And the demand is increasing! However, these demands don't come without a catch. Increased demands for leafy greens and fresh cut lettuces also come with new food safety challenges, like outbreaks of E. coli that were traced to bagged lettuce as recently as 2008. Why? Because cutting fresh produce during harvesting removes natural protective barriers, exposing cut surfaces to potential contaminants.

“Bacteria grow most rapidly in the range of temperatures between 40°F and 140°F, doubling in number in as little as 20 minutes”

-United States Department of Agriculture (2013)

Of course, washing and sanitizing the leafy greens is an important part of ridding the produce of microbial contaminants, but it's not the only way.



If you guessed that monitoring temperature contributes to lettuce health, you're right. In fact, studies have found that processing and packaging leafy greens in ambient temperatures that are too warm provide an opportunity for pathogens to grow and acquire resistance, which in turn, gives them the ability to breach the human gastric barrier and cause disease. In the case of produce, which begins to rot and spoil immediately after it's pulled from the soil, simply because it's not linked to a water source from the original plant, creating a cold processing environment that stunts the growth of dangerous pathogens, like E. coli, for example, is extremely important. So what lesson have we

learned? That proper storage temperature of leafy greens is important in minimizing bacterial adaptability and ensuring the safety of popular produce.

Whether it be chicken or cod or romaine lettuce, in order to guarantee that people are consuming a safe product, cold storage temperatures during the processing and packing stage of the cold chain are absolutely necessary to ensure that produce doesn't spoil or become infected with microbial bacterium, with each passing day, on the way to your plate.

Summary and Key Points:

- 1.** During the processing stage, food from the farm undergoes a series of cleaning, treatments, and preparations that make it safe for consumption before it can be transported to restaurants and grocery stores.
- 2.** Overall, the consensus is that temperatures of 41° F or below prevent the growth of pathogens in perishable food items, so creating a cold processing environment in which temperature is carefully monitored is crucial in maintaining the health and quality of food products.
- 3.** Whether it be a harvested crop or a harvested protein, the processing stage is one that cannot be skipped because without it, the annual number of foodborne illness cases would be exponentially higher.

Chapter 3: Transportation





The chickens have been packaged. The seabass has been ice-packed. The leafy greens have been washed and sealed. The time has come for your food to begin its journey, near or far, to restaurants and grocery stores across the country, or perhaps, even across seas.

Today, the list of advancements made by refrigeration technologies, beyond the obvious reduction of bacterial growth and spoilage in food, is not a short one. Before the early 20th century, people's diets were greatly affected by the seasons and what could be grown relatively close to their region. Thank goodness for refrigerated trucks and train cars, for without them, your diet would be seriously restricted to your local and regional foods. Refrigeration advancements, particularly in trucks and trains, loosened the restrictions on these limitations, because foods could now be transported greater distances with less potential for spoilage. It allowed for a more diversified diet for people across the country. Refrigerated transport is why we can eat Chilean Sea Bass in New York, Maine lobster in Los Angeles, and Pacific Northwest oysters in Santa Fe. In fact, did you know that in the United States, the average distance that food travels to reach a consumer is 1,300 miles? Because your food is traveling such great distances to get to your plate, safe food transportation is critical to store the food within the temperature safe zone before consumption. Improper processes can and will lead to food spoilage and food poisoning.

To prevent economic loss and public health risk, the Food and Drug Administration (FDA) Food Code requires that all hot foods be maintained at temperatures of 135° F or above and that all cold food be kept at temperatures below 41° F to reduce bacteria growth.

As you could probably guess, transportation and handling of perishable food items directly affect food item health and product quality. Refrigeration plays a vital part in maintaining the health and safety of perishable food items like dairy, meat, poultry, seafood, and produce, and if ideal temperatures aren't maintained throughout the cold chain, then the potential for bacterial growth and spoilage increase exponentially. Even still, with all the knowledge we have about food safety today, food born diseases are a far more serious and frequent problem than many realize. In fact, according to the FDA, the Federal government estimates that there are roughly 48 million cases of food born illness outbreaks annually. That's 1 in 6 Americans every year! What's worse is that each year these illnesses result in an estimated 128,000 hospitalizations and 3,000 deaths. They're alarming statistics, not only because of the staggering number of people that are dying each year due to food related illnesses, but because with refrigeration technologies of the modern day, there should be no reason that the number of fatalities should be that high! Sure, it's true that not all food born illnesses are a result of poor refrigeration practices, but, they certainly don't help. Actually, according to the FDA, the number of bacteria that cause food born sickness in consumers can double every 20 minutes on food stored at room temperature!

Meat, poultry and egg products are especially susceptible to contamination from a wide variety of physical, microbial, chemical and radiological agents. As it turns out, poultry products, our favorite and most widely consumed protein, are particularly vulnerable to microbiological hazards because their moisture, pH levels and high protein content provide ideal environments for bacteria growth. Luckily, careful temperature monitoring and safe, cold storage during the transportation stage can help prevent the microbial growth and spoilage.

Or how about the transportation of seafood? As seafood has become a more popular protein choice with health conscious consumers, developments have been made in the preservation and transportation of fish. Still, there are huge challenges in the maintenance of the cold chain for fresh, chilled and frozen fish products. Unfortunately, spoilage cannot be stopped in fish. It can, however, be controlled. The two most important words to remember when dealing with seafood transportation are “time” and “temperature”. This is because fish begins to spoil the moment it is caught and this spoilage continues throughout its shelf-life. Spoilage occurs mainly because of enzyme activity, bacterial growth and, sometimes, oxidation.

Bacteria is the major cause of fish spoilage and can cause some serious cases of food poisoning. You may be horrified to learn that millions of bacteria live on the skin, gills, and intestines of live fish and after they are caught these bacteria invade the flesh of the fish through the gills, skin, and belly cavity lining. But, don't let this ruin your appetite for fish n' chips just yet. The control of spoilage by the reduction of temperature is a common, practical, and successful way of keeping fish fresh and safe for eating. In fact, the lower the storage temperature, the longer it will take the fish to spoil. Higher temperatures increase the rate of bacterial growth, enzyme activity and oxidation leading to rapid spoilage, decreased shelf-life, and food safety risks. Not to mention, poor temperature control leads to increased waste and decreased profits for businesses.

Still, if you're not a meat eater, unfortunately you're not exempt from consuming foods that are susceptible to contracting bacterial infections during transportation. Actually, to almost no surprise, a recent study published in the February issue of Journal of Food Protection, found that fluctuations in temperature during transportation and retail sale of leafy greens negatively impacts both the products quality and microbial safety. As it turns out, fluctuations in temperature during transportation significantly increase the risk of E. coli and Listeria in leafy greens.



Commodity Information		
Commodity	Country of Origin	Transport Method
Table Grapes	Chile	Ship
Navel Oranges	Australia	Ship
Wine	France	Ship
Garlic	China	Ship
Rice	Thailand	Ship
Fresh Tomatoes	Mexico	Truck
Fresh Tomatoes	Netherlands	Airplane
Total Agricultural Products	Multiple	Ship, Truck, & Airplane

Here's the bottom line: Refrigeration is key. Currently, up to 33% of perishable foods are lost to spoilage and bacterial infection during transportation, not to mention the loss of product due to improper storage at retail level. For the food industry, that's about \$35 billion in annual reported losses of perishable product. Yikes!

It's difficult to discount the advantages that refrigeration brings to our lives. Healthier societies, diversified diets, reduced spoilage and slowed bacterial growth are just some of the improvements that modern refrigeration practices guarantee. Refrigeration also allows for a more hygienic handling and storage of perishable foods, and as a result, promotes output growth, consumption, and nutrition. Sure, food born illnesses and bacterial growth in food items are still very problematic in modern society, but in numbers that are dwarfed compared with those in the days before cold storage transportation. With effective refrigeration trucks come improvements in the quality of food nutrients and the reduction of food born illnesses.

Summary and Key Points:

- 1.** Refrigeration advancements, particularly in trucks and trains, loosened the restrictions on these limitations, because foods could now be transported greater distances with less potential for spoilage.
- 2.** To prevent economic loss and public health risk, the Food and Drug Administration (FDA) Food Code requires that all hot foods be maintained at temperatures of 135° F or above and that all cold food be kept at temperatures below 41° F to reduce bacteria growth.
- 3.** There are roughly 48 million cases of food born illness outbreaks annually. That's 1 in 6 Americans every year! What's worse is that each year these illnesses result in an estimated 128,000 hospitalizations and 3,000 deaths.
- 4.** According to the FDA, the number of bacteria that cause food born sickness in consumers can double every 20 minutes on food stored at room temperature.
- 5.** Currently, up to 33% of perishable foods are lost to spoilage and bacterial infection during transportation, not to mention the loss of product due to improper storage at retail level. For the food industry, that's about \$35 billion in annual reported losses of perishable product.
- 6.** Refrigeration allows for a more hygienic handling and storage of perishable foods, and as a result, promotes output growth, consumption, and nutrition.

Chapter 4: Cold Storage



At last, here we are. Your food has survived the transport phase and we have reached the storage phase of the cold chain.

It's difficult to emphasize the importance of players in the food industry to keep their perishable food items, not only clean, but also cold. It seems like it should be a no-brainer for food industry workers who should understand the standards that are kept in place in order to keep our food safe for consumption. By just adhering to these simple standards for food storage, the potential for food born illness outbreaks, widespread infection, and spoilage can be significantly improved.



There are two kinds of bacteria that perishable foods are susceptible to contracting: pathogenic bacteria, the kind of microbials that cause food born illnesses in consumers, and spoilage bacteria, which is the kind of bacteria that cause foods to develop unpleasant odors, tastes and textures. Pathogenic bacteria are usually more dangerous because they are more difficult to detect because they do not generally affect the taste, smell or appearance of the infected food. The main pathogens of concern for the food service industry are Campylobacter, E. coli, and Salmonella because they are the most common food-borne pathogens associated with human illness in the United States.

Unfortunately, bacteria exist everywhere in nature – in the soil, air, water and foods we eat. When these bacteria have the right conditions: such as nutrients, moisture, and favorable temperatures; they can grow extremely rapidly and increase to the point where consumption of them can cause serious human illness. These bacteria grow most rapidly in temperatures dubbed the “Danger Zone,” which is the range of temperatures between 40° F and 140° F. That is why refrigeration units must be kept colder than these range of temperatures. If foods, like poultry, remain in this “Danger Zone” for too long, irreversible damage can be done because there is no way to kill off the present bacteria in order to make the food safe for consumption. In some cases, bacteria exposed to “Danger Zone” temperatures can double in as little as 20 minutes! After two hours in warm temperatures, throwing the food away is the only choice, because there will be too much bacteria present. So for human safety reasons, it is important to control the storage temperature of refrigerated foods up until the time of their preparation. Temperature control is essential, not only to maintain the microbiological safety of the perishable foods, but to minimize changes in the chemical and physical properties of food.



Due to their varied natures and components, different kinds of food need to be kept in specific environments. The FDA demands constant temperature monitoring to ensure that foods are stored within the safe zone.

Raw meat and poultry usually have a higher water activity level and a neutral pH level—the optimum combination for bacterial growth. When meat is cooked or processed followed by refrigeration, the bacteria level in meat and poultry greatly reduces, yet environmental post-processing pathogen contamination might still occur. The high level of soluble nitrogen compounds found in seafood makes it more perishable than other high-protein products. Since seafood is usually harvested from the wild, it's also exposed to environmental contaminants and pathogens. Mishandling during or after processing is a main cause of foodborne illness from seafood.

Like fish and poultry products, which are extremely susceptible to spoilage and bacterial infections without proper storage, so too are produce products because once a crop is harvested, it is almost impossible to improve its quality. Actually, losses of horticultural

crops due to improper storage and handling range from 10 to 40 percent! That is why proper storage conditions, with respect to temperature and humidity, are crucial in lengthening the storage life and maintaining the quality of the product. The potential for microbial spoilage is also minimized with cold storage. Unfortunately, leafy greens have been linked to over 40 cases of foodborne illness since 1990. Think about fruits and vegetables like living tissues. Even though they are no longer attached to the plant they grew from, they breathe, just like we do, and their composition and physiology continue to change after they are harvested. After they are picked, they continue to ripen until they begin to die. The death of produce is inevitable, but it can be put off with cold storage. Proper temperatures slow water loss and therefore quality and energy reserves of the produce is prolonged.

As a general rule of thumb, the higher the temperature, the greater the potential for microbial growth and in commercial kitchens, there are multiple points that are important to monitor in terms of temperature. For kitchens that cook for crowds, chances are, their cold storage equipment most likely consists of more than just a refrigerator and freezer unit that you would find in any home kitchen. Commercial kitchens are a complex system of cold storage units that come in the form of walk-in refrigerators, frozen pantries and, food drawers that require temperature monitoring attention. Although it means that you need to monitor more points in your kitchen, one of the benefits of dividing up cold storage units is that if one fails it doesn't mean that all of the perishable product in your kitchen is doomed for the trash bin.

Today, refrigerated storage is one of the most widely practiced methods for controlling bacterial growth in perishable foods because bacterial growth slows to a much slower rate in colder temperatures. But, the growth of bacteria (even in refrigerators) does not completely stop its development – that's why food can still go bad in the refrigerator. Still, in order to minimize spoilage potential, storage of food items in cold temperatures is essential.

Summary and Key Points:

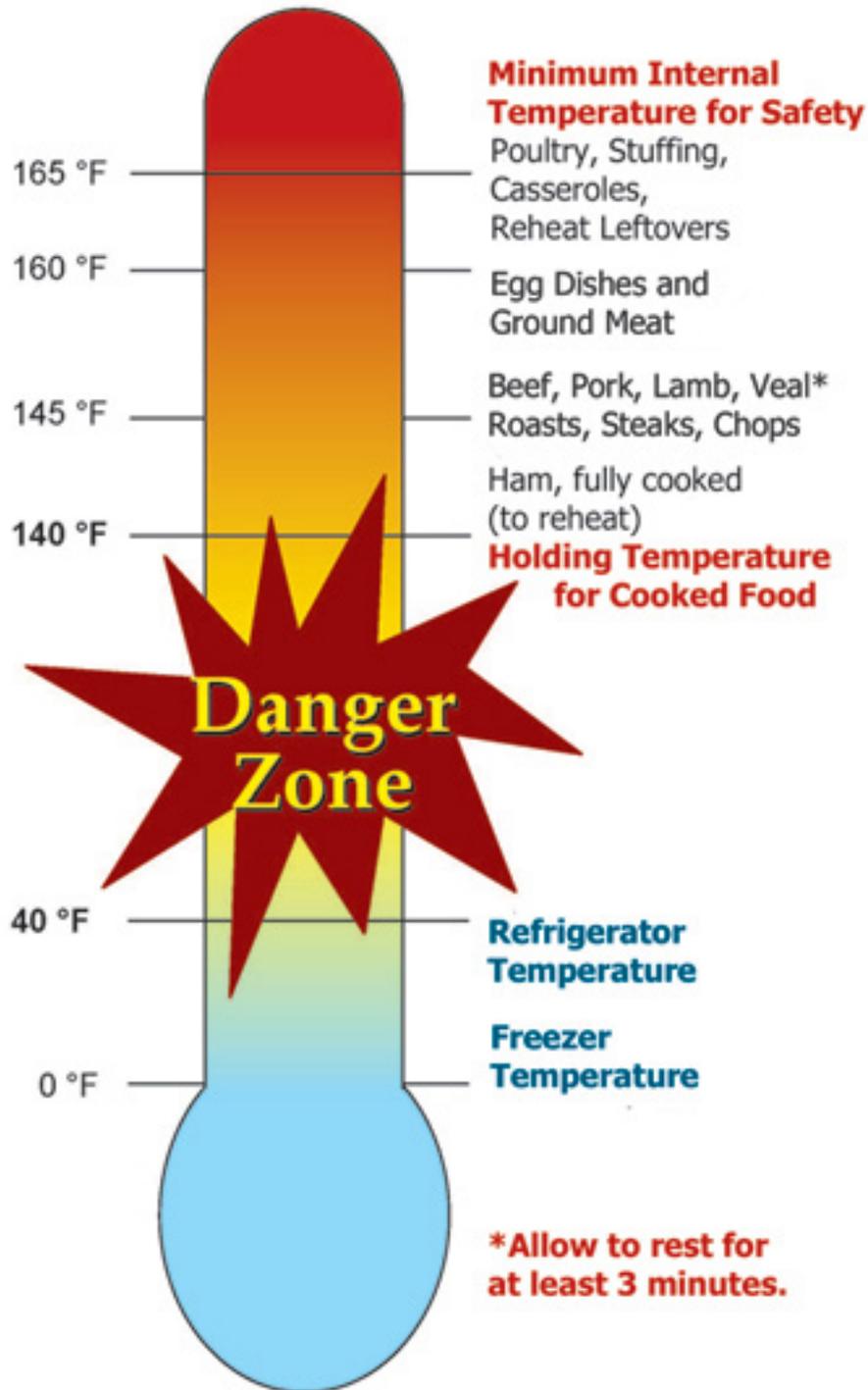
1. There are two kinds of bacteria that perishable foods are susceptible to contracting: pathogenic bacteria, the kind of microbials that cause food born illnesses in consumers, and spoilage bacteria, which is the kind of bacteria that cause foods to develop unpleasant odors, tastes and textures.
2. Pathogenic bacteria are usually more dangerous because they are more difficult to detect because they do not generally affect the taste, smell or appearance of the infected food.
3. The main pathogens of concern for the food service industry are Campylobacter, E. coli, and Salmonella because they are the most common food-borne pathogens associated with human illness in the United States.
4. Bacteria grow most rapidly in temperatures dubbed the “Danger Zone,” which is the range of temperatures between 40° F and 140° F.
5. As a general rule of thumb, the higher the temperature, the greater the potential for microbial growth.
6. Today, refrigerated storage is one of the most widely practiced methods for controlling bacterial growth in perishable foods because bacterial growth slows to a much slower rate in colder temperatures.

Chapter 5: Cooking to Temperature



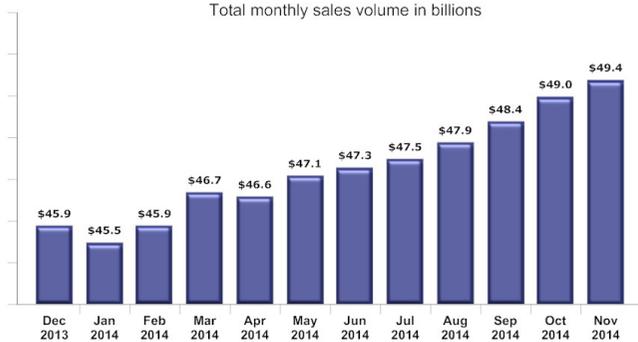
Are you hungry yet? Is your stomach grumbling? We're getting close to dinner time! All we have to do before you can dig your teeth into that chicken sandwich is make sure it's cooked to proper temperature.

Making sure that your food is cooked properly is almost, if not as important as storing food at safe temperatures, because when food is safely cooked, or when it reaches a high enough internal temperatures, harmful bacterias that cause food born illnesses are killed off. Actually, a leading cause of food born illness is time and temperature abuse of perishable foods and this occurs, particularly, when food is not cooked to the recomended minimum internal temperature.



Eating and Drinking Place Sales

Total monthly sales volume in billions



Source: U.S. Census Bureau; figures are seasonally-adjusted



In a day in age where dining out is the norm, the National Restaurant Association noted that two in five consumers say that eating in restaurants is an essential part of their lifestyle and restaurant industry sales are projected to total \$683.4 billion in 2014. It is of paramount importance that we start paying better attention to the journey that our food makes on its way to our plates, including making sure that it is cooked to proper temperature, so that we can be sure that what we are about to consume for dinner won't kill us.

Generally, the fever and sweats that most people call the "stomach flu" are almost always not a flu at all, but a contraction of a food born illness caused by bacterias such as E. coli and Salmonella. Chances are that if you think you have the stomach flu, you actually really have a food born illness that probably could have been prevented by cooking your food to proper temperature.

To make things consistent and easy, the U.S. Department of Agriculture (USDA) suggests cooking different foods to specific internal temperatures for at least 15 seconds to kill bacteria that could be dangerous. The recommended meat temperatures set forth by the USDA is an effort to simplify guidelines to make it easy for the public and cooks in commercial kitchens to remember.

This is where you vegetarians are lucky. Your leafy greens don't need to be cooked at all to be considered safe for consumption. But for all you meat eaters out there, cooking to temperature is vital.

"About 75% of new diseases affecting humans over the past 10 yr. were caused by bacteria, viruses & pathogens that started in animals & animal products. "

-World Health Organization (2009)

Research tells us that a significant number of poultry products contain Salmonella in their juices and the USDA says to serve poultry at 165° F to kill off this bacteria. At 165° F, the white meat of the poultry is still moist. Cook it to temperatures higher than that and you might mistake that chicken on your plate for a piece of cardboard. Take these temperature suggestions seriously! The old test of cooking chicken until the juices run clear doesn't hold much scientific weight and doesn't guarantee safety.

For fish, the USDA recommends cooking and serving at 145° F. It's easy to overcook fish, but it's also important to cook to temperature because fish carry parasites that need to be cooked to be killed.

By following these simple and easy to remember guidelines, whether you're cooking chicken, fish or meat, you can kill germs and bacteria before they infect you or your diner. And once that chicken breast or filet of salmon is cooked to temperature, get ready to chow down!

Summary and Key Points:

- 1.** A leading cause of food born illness is time and temperature abuse of perishable foods and this occurs, particularly, when food is not cooked to the recommended minimum internal temperature.
- 2.** The National Restaurant Association noted that two in five consumers say that eating in restaurants is an essential part of their lifestyle and restaurant-industry sales are projected to total \$683.4 billion in 2014.
- 3.** The U.S. Department of Agriculture (USDA) suggests cooking different foods to specific internal temperatures for at least 15 seconds to kill bacteria that could be dangerous.

Conclusion





At this point, hopefully we've made it clear that good refrigeration practices are vital in ensuring the safety and health of perishable food products. Today, we're lucky that significantly decreasing the potential of bacteria growth on our food and consequent illness is as easy as proper storage in a functional freezer or refrigerator.

Control of temperatures is vital in maintaining the quality and safety of refrigerated foods throughout the food continuum, whether it be maintaining warm temperatures for chicken eggs to facilitate hatching or cooler temperatures for preventing the growth of harmful bacterias in perishable foods that could cause food born illness. The consequences of not observing proper temperatures standards during different stages of poultry production can lead to greater health risks for not only the chicken, but also for the human consumer.

In order to ensure that our favorite dishes are safe for consumption, temperature conditions must be monitored as closely as sanitary conditions. It can be an expensive waste of time and resources when huge quantities of product have to be trashed because of improper temperature storage and although the monitoring of temperature at each, unique stage of the cold chain can seem like a daunting task, it isn't! It's a job that can be made exponentially easier by having it done automatically with the availability of efficient and accurate temperature monitoring systems that can alert appropriate people when something goes wrong and temperatures reach dangerous levels.

Here's good news! There are temperature monitoring products that can help detect problems before it's too late. Today, Cellular temperature devices serve the food service industry from farm-to-fork. In fact, in this industry, there isn't one stage that doesn't need to monitor and control temperatures to ensure that catastrophic losses, food spoilage, and bacterial growth are avoided. With temperature monitoring devices, not only can the health of the food products be more accurately guaranteed safe for consumption, but also, food industry companies and businesses can ensure maximum production rates.

At Temperature@lert we believe that every step that your food takes on its journey to your plate, temperatures should be continually monitored to avert costly and potentially dangerous disasters. The key word here is "avert" – not "mop up". Environmental monitoring products, like the color strips, have no value if they don't alert the right people in time to take corrective action. After all, it doesn't take a genius to figure out that something isn't right when you can smell your plate of oysters before they even leave the kitchen.



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