Safe Storage of Food Products

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The storage of food products, like the distribution of food products, must be done under conditions that will not be detrimental to the safety and quality of a particular food product or to other food products stored with them.

To be impartial and give an accurate evaluation, distribution center storage must be assessed based on the risks associated with the safe storage of different food products that require varying conditions. Those conditions include controlling temperature, preventing cross-contamination caused by other food and non-food products, preventing cross-contact with allergens, and preventing product tampering. Any of these, alone or in combination, can result in products becoming hazardous to the consumer and unsafe to eat.

Thorough risk assessments must be based on the severity and probability of these conditions happening, along with the consequences resulting from mitigated storage conditions that can cause adulterated or unsafe food products.

This document is intended to provide guidance to food distributors on how to store foods safely so that the end-consumer is not exposed to unsafe food. While maintaining food quality is important, the objective of this document is to layout a plan for the safe storage of foods.

Remember, trailers/trucks/vans are mobile food warehouses. Storage and palletizing should be treated with the same considerations that would happen in a distribution center. Specific transportation risks are covered in SAI Global’s White Paper Safe Distribution of Food Products.
Food Type

Storage condition requirements can vary considerably based on the type of food product – frozen, refrigerated and shelf stable – as well as whether it is raw or ready-to-eat. Additionally, the storage of allergens, non-food products (cleaning chemicals, motor oils, health and beauty aids), highly aromatic or perfumed products, soil, pesticides, herbicides, etc. in the same facility requires additional consideration. Finally, protecting foods from deliberate acts of tampering is another risk that cannot be ignored.

Given these variables, each distributor must establish risk-based storage methods for their range of products to ensure that these products or others stored with them do not become contaminated or unsafe.

Product Mix

Most food distributors do not have the luxury of being able to store different products in separate warehouses. Because of this, there are several key items to consider when evaluating storage for safety:

- Loading and unloading trailers safely to maintain temperature control (where applicable)
- Storage based on pathogen and allergen concerns (i.e., shell eggs, raw fish, and crustacean)
- Controlling risks to meet regulatory requirements, customer requirements and the consumer’s health requirements, especially around the safety of ready-to-eat foods
- Storage risks based on the distributor’s specific product mix

Safe Storage Continuity

A thorough storage safety program begins in purchasing, then flows to receiving, storage and finally shipping. Why is this continuity important? If a facility receives unsafe food there is no way they can make the food safe. That said, receiving safe food does not guarantee that a distributor will ship safe food, so storage practices must be followed to ensure product safety throughout the distribution center.
Storage Temperature Conditions

Most distribution centers are faced with the challenges of storing a mixture of products that require different temperature conditions in order to maintain food safety. This can be done safely in the same distribution center if certain basic requirements are put in place.

Frozen Foods

Frozen foods are frozen as a means of increasing the shelf life of products by inhibiting the growth of both spoilage bacteria and harmful bacteria. It is essential that distribution centers store these foods under conditions that will maintain the quality and food safety of these frozen products.

When frozen food is allowed to warm up from <0° F, it begins to thaw out and bacteria will begin to grow slowly. It should be noted that ice cream needs to be stored at -20 to -25° F so it can be stacked; it begins to slack out at temperatures any higher than -5° F.

From a food safety perspective this is not a problem as long as the food does not reach 41° F or higher. However, thawing can affect food quality and result in an unsatisfactory product for the customer or end-consumer. Frozen foods that thaw and are then re-frozen have noticeable quality issues with the possible formation of ice crystals and changes in mouth feel.

Maintaining frozen food frozen is, therefore, a food quality issue more than it is a food safety concern.

Refrigerated Foods

Although some foods requiring refrigeration do not necessarily need to be held at <41° F to maintain their food safety, this has become the acceptable temperature at which to store “perishable” foods. Most coolers should be set at 34-38° F, although each facility should evaluate this temperature based on the time of year and how expected outdoor temperatures impact the facility.

Certain products require additional temperature consideration:

- Shell eggs and shellfish can legally be stored up to 45° F. Since this temperature is too warm for other “perishable” products, these two products are generally stored at <41° F.

- Other “perishable” foods need to be closer to 32° F to keep their quality and to decrease the rate at which bacteria in or on them grows. It takes an average of 1200 minutes (20 hours) for these bacteria to double in number at 32° F; at 41° F it takes only 400 minutes (6.7 hours). For this reason, fresh raw chicken is best stored at temperatures between 30-34° F. Care must be taken to avoid the chicken temperature falling below 27° F, as this will prohibit it being sold as fresh chicken. If the cooler cannot be kept this cold, it is not unusual to place ice on the raw chicken to keep its temperature down.
• Adding ice to fresh broccoli is also a common practice to maintain quality. However, if this practice is used, broccoli pallets must not be stored over other pallets of produce. Melting ice can readily wash dirt to produce stored on pallets below, contaminating it.

• Icing products should be done in a cooler that has drains that allow water from melting ice to easily drain. Pooling water in coolers can harbor Listeria monocytogenes, a bacterium harmful to consumers health.

• Certain produce items that require some refrigeration to maintain their quality and to extend their shelf life cannot be stored below 41° F, so their storage areas will vary from 41-55° F, depending on the type of produce.

• Other produce items do not require any refrigeration (bananas, potatoes, whole tomatoes, etc.), so they tend to be stored in dry storage areas at 55-65° F or even warmer.

• For more information on various temperatures and conditions for the storage of fresh produce see http://postharvest.ucdavis.edu/produce_inform

Allowing temperature sensitive and perishable products to go outside of a certain temperature range is called temperature abuse. Temperature abuse can render these products harmful to the consumers health because of significant bacterial growth that can lead to toxin development.

• The formation of toxins can be caused by the presence of certain bacteria (Coagulase Positive Staphylococcus, Clostridium Perfringens, Bacillus Cereus) in raw foods. This toxin formation is serious because these toxins cannot be removed by cooking, frying, baking or heating the products. The toxins also cannot be detected by taste, odor or appearance, so there are no warning signs for the consumer.

• Raw fish (tuna, mahi mahi, and bluefish,) if temperature abused, can form Scrombotoxin and result in Scrombroid (Histamine) poisoning. This is a chemical hazard to which some individuals have extreme sensitivity. It cannot be detected when preparing the fish and the toxin cannot be removed when cooking the fish.

For these reasons, it is essential that “perishable” products be stored cold and protected against temperature abuse at all times, in all areas of the distribution center (receiving, storage and shipping).

**Shelf-Stable Foods**

Shelf-stable foods, due to their composition or type of packaging, do not support the growth of harmful bacteria and can be stored at ambient temperatures.

However, some of these products may require some temperature control to prevent quality issues, for example chocolate products that may melt or bloom when exposed to heat. (Bloom is caused by the cocoa butter in the chocolate rising to the surface of the chocolate products, causing them to have a “white” appearance.) A distribution center should store these temperature-controlled products in a conditioned storage area unless their facility is airconditioned.

The challenges of storing all of these types of food products – frozen, refrigerated and shelfstable – is that it requires, at a minimum, 3 different temperature storage areas.
Cross-contamination is the transfer of harmful bacteria from one product to another. If the contaminated product is a ready-to-eat product, it can become unsafe to eat and could cause a foodborne illness when consumed.

When deciding how to store food products, it is essential to consider whether food products have the potential to contain harmful bacteria that can transfer, leak or drip to other products, causing these other products to be contaminated. If contaminated products are ready-to-eat, they become hazardous to the consumer. If contaminated products are also raw, they become more contaminated with bacteria that might require a higher cooking temperature to kill the bacteria than the consumer would normally use for the product, making it harmful if consumed.

Frozen items, as long as they remain frozen, are not a storage concern as they will not drip or leak. If frozen products are allowed to thaw, they can become a storage concern, as condensation or leaking product could potentially contaminate other products.

Safe storage practices require all raw products (meat, poultry, fish, shell eggs) be stored separately from ready-to-eat products and not over other raw products, unless they are of the same type.

Relying on the integrity of the package as your only prevention against cross-contamination is not a wise decision. Soft packages such as paper and plastic bags can leak due to their nature or due to damage, resulting in products below becoming contaminated. These packages can become compromised by tears, moisture, or even through pre-manufactured holes designed to let air escape.

- In meat coolers, blood on the floor indicates that meat packages are not always leak proof;
- Iced down products such as poultry and produce can drip water; and
- Shell eggs can break if not stored carefully, transferring to products below or nearby and contaminating them.

The table in the section of this paper titled “Reference Guide When Considering How to Store Foods” is a guide for determining biological hazards associated with different food products.
According to the Food Allergy and Anaphylaxis Network, an estimated 4% of adults and 8% of children have food allergies, and a 2008 study by the U.S. Centers for Disease Control and Prevention (CDC) indicates that among children, these allergies have increased by nearly 18% over the last decade. Foods containing allergens require special storage conditions, so it is important to take these needs into consideration while determining or evaluating storage at your facility.

Cross-contact of products with allergens can make non-allergen foods hazardous to the consumer. Contamination may not be noticeable to the consumer. Those individuals with sensitivity that consume a contaminated food could have an allergic reaction that can be as severe as anaphylactic shock or even death.

When deciding how to store allergens, a distribution center needs to determine which products in its mix are allergens and in what type of package are they packaged. All employees should be educated on what allergens are and which products contain allergens and thereby need to be stored correctly so as to not contaminate other food products in the distribution center.

In the United States, the CDC has identified eight major allergens that cause 90% of all food allergy reactions.

- Peanuts
- Tree nuts (almonds, walnuts, pecans, etc.)
- Fish
- Seafood (shrimp, lobster and crab)
- Wheat
- Soy
- Eggs
- Dairy products (milk, yogurt, etc.)

Not all allergen-containing products need to be handled as carefully as others as the risk of cross-contamination is sufficiently low if the product that contains an allergen is in a hard type package (glass, metal, cardboard) and plastic (if not a liquid, which can be prone to leaks).

The highest-risk products that need to be handled with care are those which are 100% allergen (shell eggs, milk, peanuts, flour, wheat, soy, fresh fish, tree nuts, seafood, etc.) and those packaged in fragile paper or plastic packaging. Fragile packaging increases the likelihood for these products to leak, break or spill out and potentially contaminate other products.

When developing a program for the safe storage of allergens, it is essential that each distribution center develop a list of all allergens carried at the facility and the type of containers in which these allergens are packaged.
Specific storage concerns around each of these allergens are listed below.

- **Shell eggs** are high risk because they are an allergen and because of their tendency to contain pathogenic bacteria. Therefore, shell eggs should never be stored above anything other than other shell eggs. Shell eggs are fragile and can break at any time, but especially if heavy products are placed on top of them.

- **Liquid eggs**, although safe from harmful bacteria if they have been pasteurized, are still an allergen and need to be treated in the same manner as shell eggs for storage, with one exception: they cannot be placed under shell eggs, only over shell eggs. This is because shell eggs, if stored above liquid eggs, could break and contaminate the liquid eggs with pathogenic bacteria.

- **Liquid milk** cannot be allowed to drip down onto non-milk containing products. Care must be taken in how liquid milk products are stored with other non-dairy products. Liquid milk containers, including plastic gallons, half gallons and quarts, tend to leak, so make sure they are placed under other products.

Concerns with yogurt, cottage cheese, butter and sour cream are minimal as these products generally do not leak and, unless the casing is damaged, are not likely to contaminate other non-milk containing products.

- **Wheat flour** and **soy flour** are generally packaged in paper bags or sacks that tend to allow the contents to come out of the package and contaminate the surroundings, even when the package is not damaged. This is clearly visible in distribution center slots where flour is stored. If the package gets damaged, then large quantities of these allergens will be spread around. When placing these products in slots, it is preferable for them to be in the bottom slot with similar product stored above and to either side. However, extra caution should be taken to avoid storing soy and wheat flours in ways they could contaminate one another. Soy and wheat are different allergens so these products cannot be stored over each other.

- **Peanuts in string bags** and **tree nuts** must be stored separately and away from different types of nuts if the warehouse carries different types.

- **Fresh fish and seafood** must to be stored away from other products unless in containers (pails, glass, cans) where the risk of leakage is very low.
Reference Guide When Considering How to Store Food Products

Storage Conditions Designed to Avoid Contamination of Foods by Non-Food Products

<table>
<thead>
<tr>
<th>FOOD ITEM</th>
<th>BACTERIAL CONCERNS</th>
<th>ALLERGEN CONCERNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shell Eggs</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Liquid Pasteurized Eggs</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Peanuts</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Tree Nuts</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Liquid Milk Products</td>
<td>No*</td>
<td>Yes</td>
</tr>
<tr>
<td>Flour (Wheat)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Soy Powders</td>
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<td>Yes</td>
</tr>
<tr>
<td>Raw Fish (Fresh)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Raw Seafood</td>
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<td>Yes</td>
</tr>
<tr>
<td>Raw Meats (Pork, Beef, Lamb)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Raw Poultry</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Raw Produce</td>
<td>Possibly</td>
<td>No</td>
</tr>
</tbody>
</table>

*except raw milk

Every precaution should be taken to prevent contamination by non-food products.

This review would not be complete without considering the possibilities of contamination of food products by the unsafe storage of non-food products.

Non-Food Products

There are many items that can be classified as non-food products, including cleaning chemicals, bags of soil, retail pesticides, herbicides, motor oils, pharmaceutical products, and more. Although it is not illegal to store these products in a food distribution center, every care should be taken to avoid any contact between these non-edible products and human or animal foods.

Non-food products should be segregated in storage slots a minimum of 4 feet away from food products. This 4-foot distance applies to the front, back and to the side in order to protect food products from exposure to odors or spillage of non-food products.
Battery Charging Areas

When charging the batteries for equipment used in distribution centers such as forklifts and pallet jacks, acid fumes are emitted from charging areas. These fumes could contaminate food products or packaging stored either over or within about 8 feet of chargers. Caution should be taken to avoid storing foods in proximity to chargers.

Food Security

Since the terrorist attacks of September 11, 2001, government and regulatory authorities have stressed the need for increased vigilance against intentional tampering that would contaminate foods with dangerous bacteria or make them unsafe to eat in any way.

To date, the best practice to maintain food security is to keep all of facility doors, pedestrian and dock, locked at all times except when receiving or shipping products. Remember, fire code in most areas prohibits exit doors to be locked from the inside, so consult the local fire marshal if there is question around a specific entry.

Resources


SAI Global helps organizations manage risk, achieve certification and drive improvement by providing training, registration audits, and supplier management programs that can improve business performance. With more than 800 auditors and 24,000 registrations worldwide, we are a global leader committed to exceptional customer service and advancing business excellence.

We’re focused not only on evaluating business practices against a standard, but also on understanding how compliance with those standards can improve the operations of our customers. SAI Global auditors are industry veterans with years of experience in the sectors they serve, enabling them to interpret the standards precisely.

For more information about food safety programs, contact SAI Global at certification.americas@saiglobal.com or visit www.saiglobal.com/assurance