Slide 96

The content presented in this section is based on the Part 3-3 Protection from Contamination after Receiving of the 2005 Food Code. The Food Code in its entirety is available at: http://www.cfsan.fda.gov/~dms/fc05-toc.html

Slide 97

TYPES OF STORAGE

Cleaning and chemical storage

• Cleaning supplies and chemicals should be stored away from food.
• Keep supplies and chemicals in their original containers.
• If supplies and chemicals are not in their original containers, clearly label.

Dry storage

• Storerooms should be cool, dry, clean, well lighted and well ventilated.
• Food items must be kept off the floor.
• Food items should be kept in containers that cannot be damaged by water or a possible pest infestation.

Frozen storage

• Freezers keep food at 0°F or below.
• Freezers are never intended to cool food.
• Freezers should not be overloaded.

Refrigerated storage

• Refrigerators are used for short-term holding at 41°F or below.
• Food must be stored correctly to minimize the possibility of foodborne illness and cross-contamination.
• Refrigerated storage temperatures vary from product to product.

Blast chill refrigeration

• Blast chillers are used to quickly cool foods to below 41°F.

Deep chill refrigeration

• Deep chill refrigeration keeps food at a colder temperature. This may extend the shelf life of the food items.

BACKGROUND INFORMATION ABOUT REFRIGERATION AND FREEZING

The fundamental reason for having a refrigerator is to keep food cold. Cold temperatures help food stay fresh longer. The basic idea behind refrigeration is to slow down the activity of bacteria so that it takes longer for the bacteria to spoil the food. Bacteria will spoil milk in two or three hours if the milk is left out on the kitchen counter at room temperature. However, by reducing the temperature of the milk, it will stay fresh for a week or two -- the cold temperature inside the refrigerator decreases the activity of the bacteria

that much. By freezing the milk you can stop the bacteria altogether, and the milk can last for months (until effects like freezer burn begin to spoil the milk in non-bacterial ways).

Parts of a Refrigerator

The basic idea behind a refrigerator is very simple: It uses the evaporation of a liquid to absorb heat. When you put water on your skin it makes you feel cool. As the water evaporates, it absorbs heat, creating that cool feeling. Rubbing alcohol feels even cooler because it evaporates at a lower temperature. The liquid, or **refrigerant**, used in a refrigerator evaporates at an extremely low temperature, so it can create freezing temperatures inside the refrigerator. If you place your refrigerator's refrigerant on your skin (definitely NOT a good idea), it will freeze your skin as it evaporates.

There are five basic parts to any refrigerator:

1. **Compressor**
2. **Heat-exchanging pipes** - serpentine or coiled set of pipes outside the unit
3. **Expansion valve**
4. **Heat-exchanging pipes** - serpentine or coiled set of pipes inside the unit
5. **Refrigerant** - liquid that evaporates inside the refrigerator to create the cold temperatures Many industrial installations use pure ammonia as the refrigerant. Pure ammonia evaporates at -27 degrees Fahrenheit (-32 degrees Celsius).

The basic mechanism of a refrigerator works like this:
The compressor compresses the refrigerant gas. This raises the refrigerant's pressure and temperature (orange), so the heat-exchanging coils outside the refrigerator allow the refrigerant to dissipate the heat of pressurization.
As it cools, the refrigerant condenses into liquid form (purple) and flows through the expansion valve. When it flows through the expansion valve, the liquid refrigerant is allowed to move from a high-pressure zone to a low-pressure zone, so it expands and evaporates (light blue). In evaporating, it absorbs heat, making it cold.
The coils inside the refrigerator allow the refrigerant to absorb heat, making the inside of the refrigerator cold. The cycle then repeats.

Here is how it works:
The **compressor** compresses the ammonia gas. The compressed gas heats up as it is pressurized (orange).
The **coils** on the back of the refrigerator let the hot ammonia gas dissipate its heat. The ammonia gas condenses into ammonia liquid (dark blue) at high pressure.
The high-pressure ammonia liquid flows through the **expansion valve**.
You can think of the expansion valve as a small hole. On one side of the hole is high-pressure ammonia liquid. On the other side of the hole is a low-pressure area (because the compressor is sucking gas out of that side).
The liquid ammonia immediately boils and vaporizes (light blue), its temperature dropping to -27 F. This makes the inside of the refrigerator cold.
The cold ammonia gas is sucked up by the **compressor**, and the cycle repeats.

Pure ammonia gas is highly toxic to people and would pose a threat if the refrigerator were to leak, so all home refrigerators don't use pure ammonia. You may have heard of refrigerants know as **CFCs** (chlorofluorocarbons), originally developed by DuPont in the 1930s as a non-toxic replacement for ammonia. CFC-12 (dichlorodifluoromethane) has about the same boiling point as ammonia. However, CFC-12 is not toxic to humans, so it is safe to use in your kitchen. Many large industrial refrigerators still use ammonia.

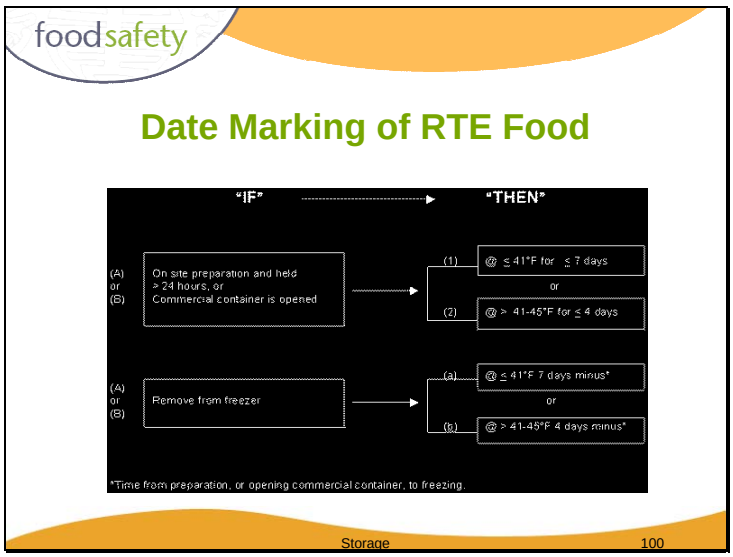
Slide 98


foodsafety
First In, First Out (FIFO)
• Past-dated foods will lose their quality and sometimes become unsafe.
• FIFO ensures proper rotation of foods in storage.
• When foods are received, put the oldest in the front and the newest in the back.
• Identify package date, preparation date, or date of purchase.
Storage
98

Slide 99

See the Speaker Notes for Slide 100 for more information.

Slide 100



Refrigeration prevents food from becoming a hazard by significantly slowing the growth of most microbes. The growth of some bacteria, such as *Listeria monocytogenes*, is significantly slowed but not stopped by refrigeration. Over a period of time, this and similar organisms may increase their risk to public health in ready-to-eat foods.

The date by which the food must be eaten takes into consideration the differences in growth of *Listeria monocytogenes* at 5°C (41°F) and 7°C (45°F). Based on a predictive growth curve modeling program for *Listeria monocytogenes*, ready-to-eat, potentially hazardous food may be kept at 5°C (41°F) a total of 7 days or at 7°C (45°F) a total of 4 days. Therefore, the period of time allowed before consumption is shortened for food in refrigerators incapable of maintaining food at 5°C (41°F) but capable of maintaining it at 7°C (45°F) or below. Food which is prepared and held, or prepared, frozen, and thawed must be controlled by date marking to ensure its safety based on the total amount of time it was held at refrigeration temperature, and the opportunity for *Listeria monocytogenes* to multiply, before freezing and after thawing. Potentially hazardous refrigerated foods must be consumed, sold or discarded by the expiration date.

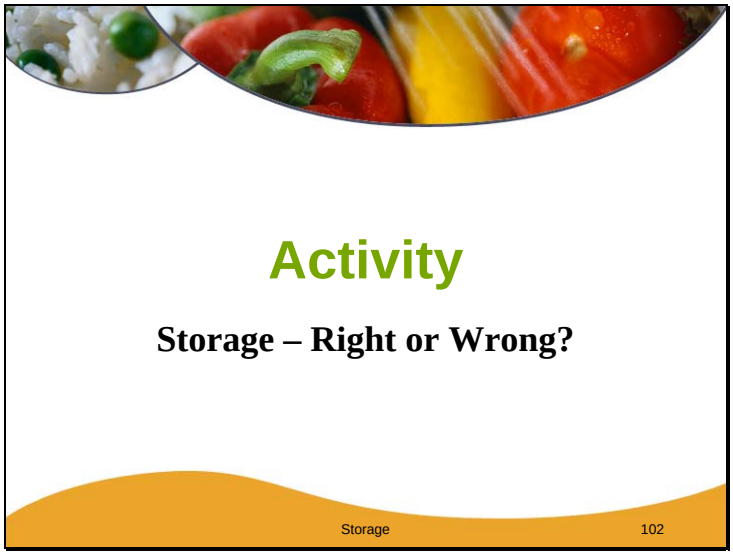
Date marking is the mechanism by which the Food Code requires active managerial control of the temperature and time combinations for cold holding. Industry must implement a system of identifying the date or day by which the food must be consumed, sold, or discarded. Date marking requirements apply to containers of processed food that have been opened and to food prepared by a food establishment, in both cases if held for more than 24 hours, and while the food is under the control of the food establishment. This provision applies to both bulk and display containers. It is not the intent of the Food Code to require date marking on the labels of consumer size packages.

A date marking system may be used which places information on the food, such as on an overwrap or on the food container, which identifies the first day of preparation, or alternatively, may identify the last day that the food may be sold or consumed on the premises. A date marking system may use calendar dates, days of the week, color-coded marks, or other effective means, provided the system is disclosed to the Regulatory Authority upon request, during inspections.

Slide 101

Cross-contamination can be prevented by separating raw animal foods from ready-to-eat foods. Cross-contamination may also occur when raw unprepared vegetables contact ready-to-eat potentially hazardous foods. Raw animal foods must also be separated from each other because required cooking temperatures are based on thermal destruction data and anticipated microbial load. These parameters vary with different types of raw animal foods. Food that is inadequately packaged or contained in damaged packaging could become contaminated by microbes, dust, or chemicals introduced by products or equipment stored in close proximity or by persons delivering, stocking, or opening packages or overwraps. Packaging must be appropriate for preventing the entry of microorganisms and other contaminants, such as chemicals. These contaminants may be present on the outside of containers and may contaminate food if the packaging is inadequate or damaged, or when the packaging is opened.

Slide 102

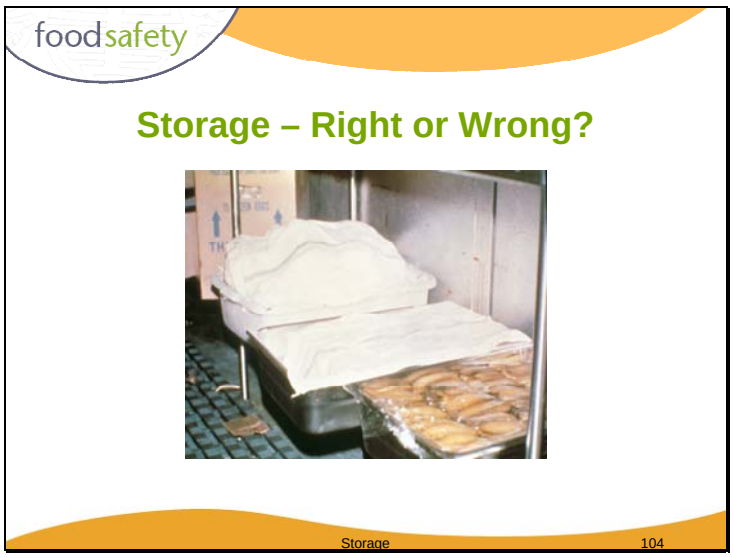


ACTIVITY INSTRUCTIONS: Show the program participants the following slides and have them determine if the storage situation is right or wrong.

Slide 103

Wrong – personal belongings stored in a messy storeroom.

Slide 104



Wrong -- because not allowed to use cloth to cover foods.

Slide 105

Wrong -- because storing chemicals with foods.

Slide 106

Right and Wrong – boxes of fruit need to be off of the floor. Bins of food are covered.

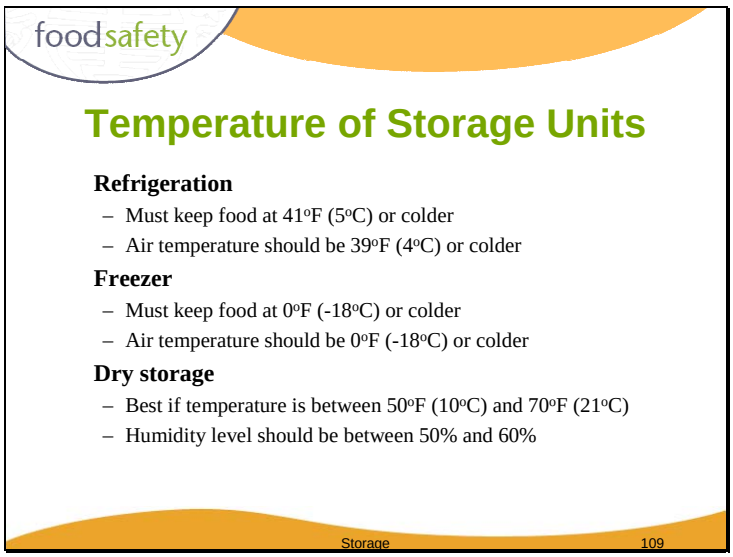
Slide 107

Right -- Food is stored in a clean, dry location, where it is not exposed to splash, dust, or other contamination, at least 6 inches above the floor. All containers/packages appear to be in good condition.

Slide 108

Right -- Milk is stored in a clean refrigerator. The containers of milk appear to be clean and in good condition. There needs to be a thermometer in the refrigeration unit.

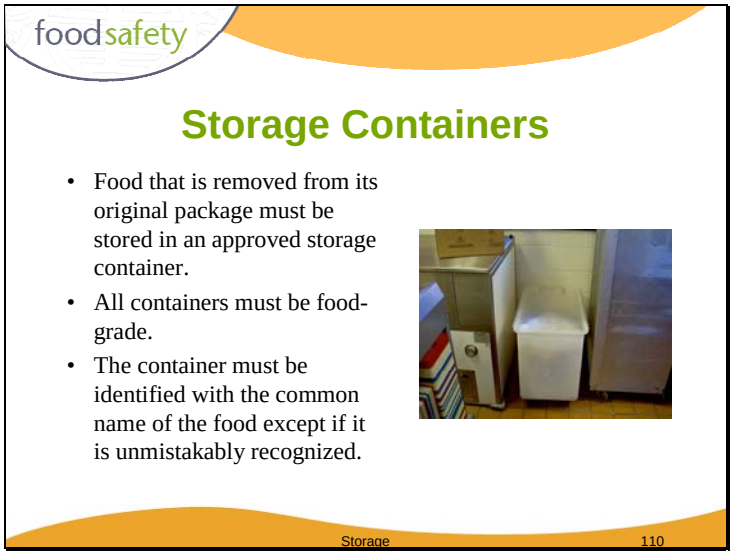
Slide 109



Cross-contamination can be avoided by separating raw animal foods from ready-to-eat foods. Cross-contamination may also occur when raw unprepared vegetables contact ready-to-eat potentially hazardous foods. Raw animal foods must also be separated from each other because required cooking temperatures are based on thermal destruction data and anticipated microbial load. These parameters vary with different types of raw animal foods. Packaging must be appropriate for preventing the entry of microbes and other contaminants such as chemicals. These contaminants may be present on the outside of containers and may contaminate food if the packaging is inadequate or damaged, or when the packaging is opened. The removal of food product overwraps may also damage the package integrity of foods under the overwraps if proper care is not taken.

Food Storage Containers, Identified with Common Name of Food.
Certain foods may be difficult to identify after they are removed from their original packaging. Consumers may be allergic to certain foods or ingredients. The mistaken use of an ingredient, when the consumer has specifically requested that it not be used, may result in severe medical consequences. The mistaken use of food from unlabeled containers could result in chemical poisoning. For example, foodborne illness and death have resulted from the use of unlabeled salt, instead of sugar, in infant formula and special dietary foods. Liquid foods, such as oils, and granular foods that may resemble cleaning compounds are also of particular concern.

Slide 110



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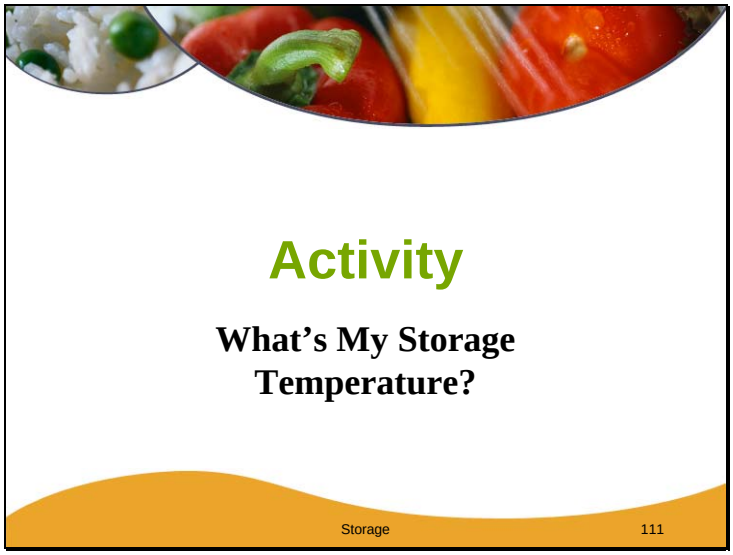
Slide 111



ACTIVITY INSTRUCTIONS: Ask participants to identify the proper storage temperature for the foods listed on slides 112-116. Remind participants that all potentially hazardous foods must be kept at 41F or colder or 135F or hotter during storage. The only exceptions to this rule are that shell eggs and shellstock can be stored at 45F or colder.

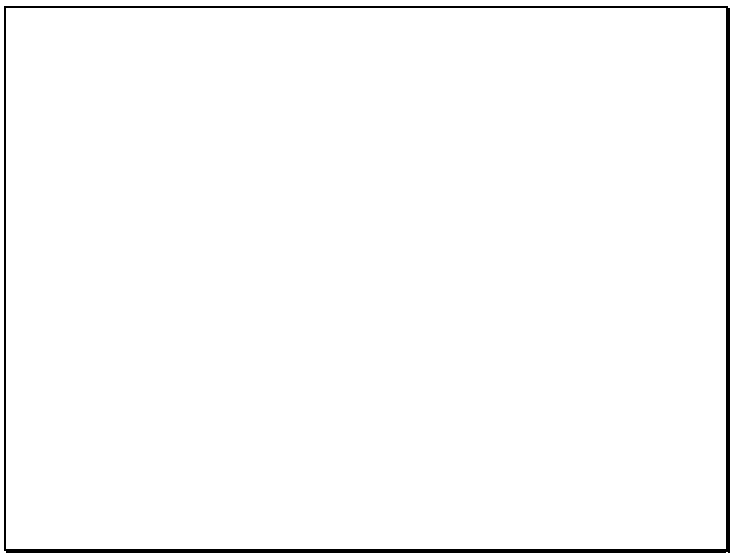
Slide 112

Canned foods – 50 to 70 degrees F
Milk – 41 degrees F or colder

Slide 113

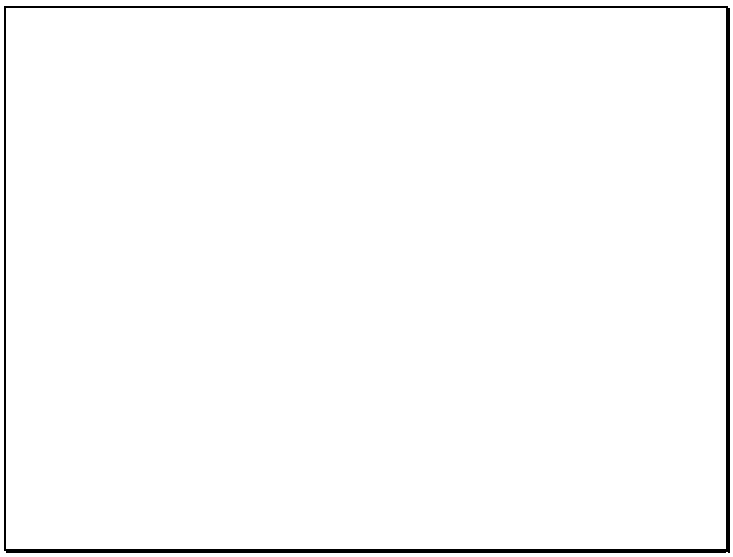
Whole, uncut fruit – The temperature varies for different types of produce. Once the produce is cut it needs to be kept at 41 degrees F or colder. Storage temperatures for produce are available at:http://ohioline.osu.edu/fresh/Storage.pdf
Fresh fish – 41 degrees F or colder

Slide 114



Frozen turkey – 0 degrees F or colder
Chicken salad – 41 degrees F or colder

Slide 115

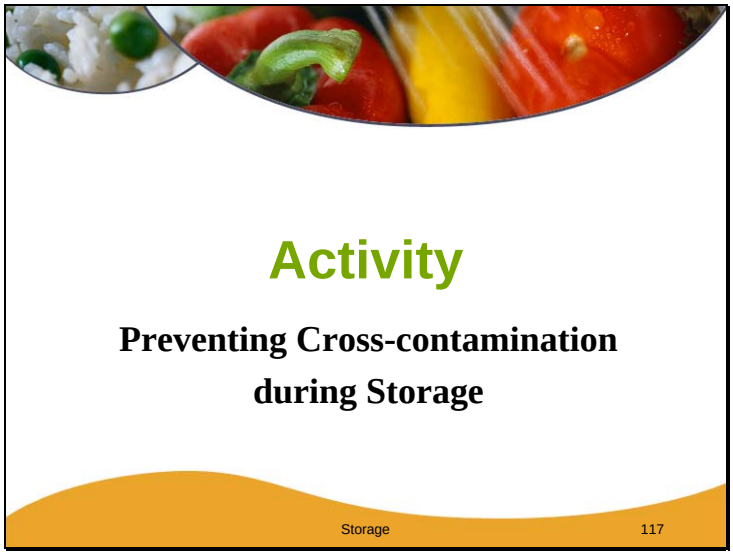


Fresh cut watermelon – 41 degrees F or colder
Crackers – 50-70 degrees F

Slide 116

UHT dairy creamers – it depends. If the package states "Keep Refrigerated", then the product must be at 41 degrees F or colder. If the label states "Does not Require Refrigeration", then product can be kept at room temperature (50 to 70 degrees F).
Raw pork – 135 degrees F if stored on a steam table; 41 degrees F or colder if stored in the refrigerator.

Slide 117



ACTIVITY INSTRUCTIONS: The instructions for this activity are available at: http://www.foodsafetysite.com/resources/pdfs/foodservice/st-refrigerator.pdf
Additional activities are available at: http://www.foodsafetysite.com/foodservice/conducting/storage/