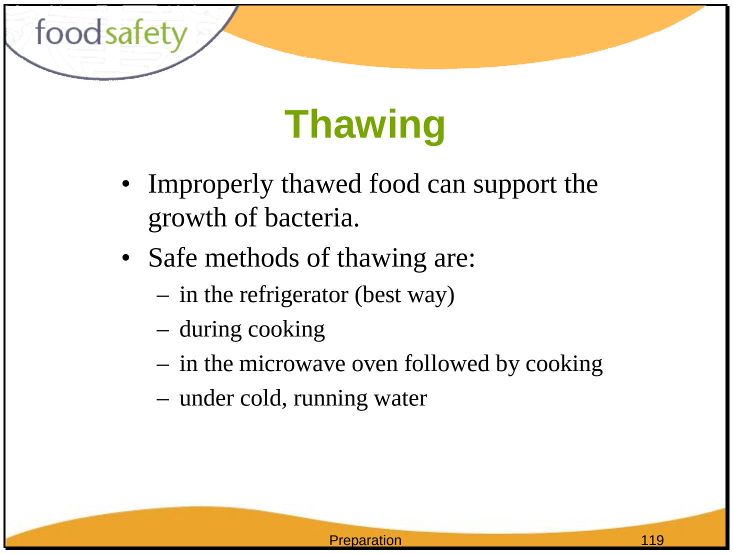
Slide 118

The content presented in this section is based on Part 3-4 through Part 3-8 of the 2005 Food Code. The Food is available in its entirety at: http://www.cfsan.fda.gov/~dms/fc05-toc.html

Slide 119



Freezing prevents microbial growth in foods. Freezing can kill some but not all microorganisms. Therefore, if a food was temperature-abused before freezing, it could be unsafe to eat after thawing, particularly if the food was improperly thawed. Improper thawing provides an opportunity for surviving bacteria to grow to harmful numbers and possibly produce toxins. If the food is then refrozen, significant numbers of bacteria and all preformed toxins are preserved. Potentially hazardous food must be thawed by one of four methods:

under refrigeration that maintains the food temperature at 5°C (41°F) or below, or at 7°C (45°F) or below.

completely submerged under running water that is at 70°F or colder. The food should not be at temperatures above 40°F for more than 4 hours

as part of a cooking process if the food that is frozen is cooked to a proper endpoint cooking temperature or is thawed in a microwave oven and immediately transferred to conventional cooking equipment, with no interruption in the process.

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ACTIVITY INSTRUCTIONS: Have the program participants determine if the following situations depicted on the following slides are right or wrong.

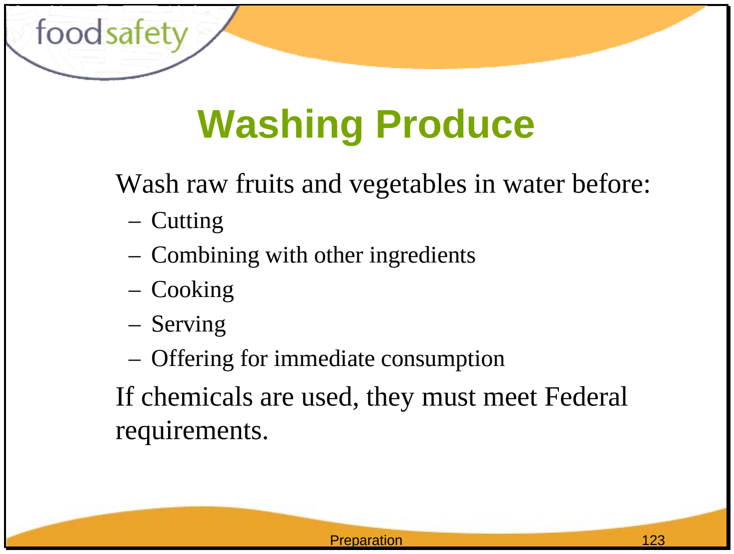
Slide 121

Wrong – at room temperature in standing water.

Slide 122

Right -- Meat on the bottom shelf of a refrigerator so that drip cannot contaminate cooked or ready-to-eat food.

Slide 123



Pathogenic microorganisms and chemicals may be present on the exterior surfaces of raw fruits and vegetables. Washing removes the majority of organisms and/or chemicals present. If nondrinking (unsafe) water is used, the fruits and vegetables could become contaminated. Toxic or undesirable residues could be present in or on the food if chemicals used for washing purposes are unapproved or applied in excessive concentrations. On October 26, 1998 a voluntary guidance document which addresses practices commonly used by fresh fruit and vegetable producers was issued jointly by FDA, USDA, and CDC. This voluntary guidance contains useful information related to washing fruits and vegetables as well as the application of antimicrobial agents. The "Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables" is available from FDA's Food Safety Initiative staff and also on the Internet at http://www.fda.gov.

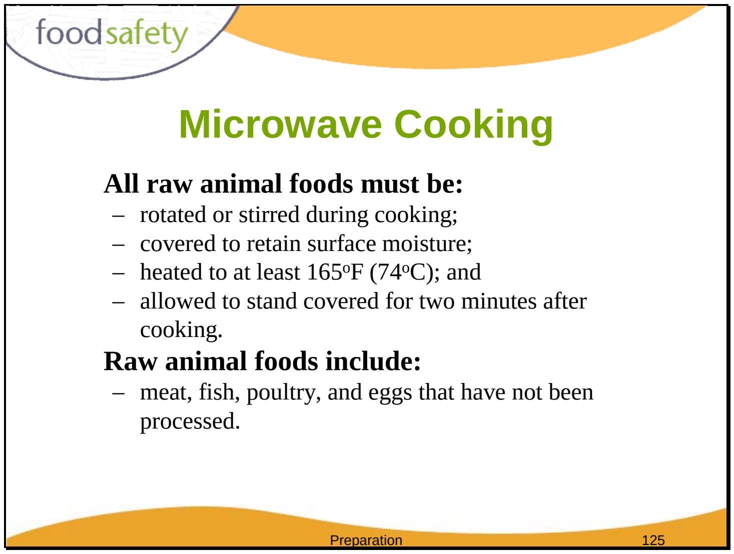
Slide 124

Cooking Temperatures

Poultry	165°F (74°C)
Stuffing or stuffed meat	165°F (74°C)
Ground meats	155°F (68°C)
Injected meats	155°F (68°C)
Pork, beef, veal, and lamb	145°F (63°C)
Fish	145°F (63°C)

Minimum internal cooking temperatures are based on a number of factors. These include: (1) the anticipated level of pathogenic bacteria in the raw product, (2) the initial temperature of the food, and (3) the food's bulk, which affects the time to achieve the needed internal product temperature. Other factors to be considered include post-cooking heat rise and the time the food must be held at a specified internal temperature. To kill pathogens, food must be held at a sufficient temperature for the specified time. There are a variety of time/temperature combinations for specific foods that can be equally effective. For example, when cooking a beef roast, the microbial lethality achieved at 112 minutes after it has reached 130°F is the same lethality attained as if it were cooked for 4 minutes after it has reached 145°F. The microbial lethality using these criteria will eliminate over 99.9999% of the *Salmonella* that is on the product. Cooking requirements are based in part on the biology of pathogens. The thermal destruction of a microorganism is determined by its ability to survive heat. Different species of microorganisms have different susceptibilities to heat. Also, the growing stage of a species, such as the vegetative cell of bacteria, is less resistant than is the spore form of a bacterium. Food characteristics also affect the lethality of cooking temperatures. Heat penetrates into different foods at different rates. High fat content in food reduces the effective lethality of heat. High humidity within the cooking vessel as well as the moisture content of food aid thermal destruction. Heating a large roast too quickly with a high oven temperature may char or dry the outside, creating a layer of insulation that shields the inside from efficient heat penetration. To kill all pathogens in food, cooking must bring all parts of the food up to the required temperatures for the correct length of time.

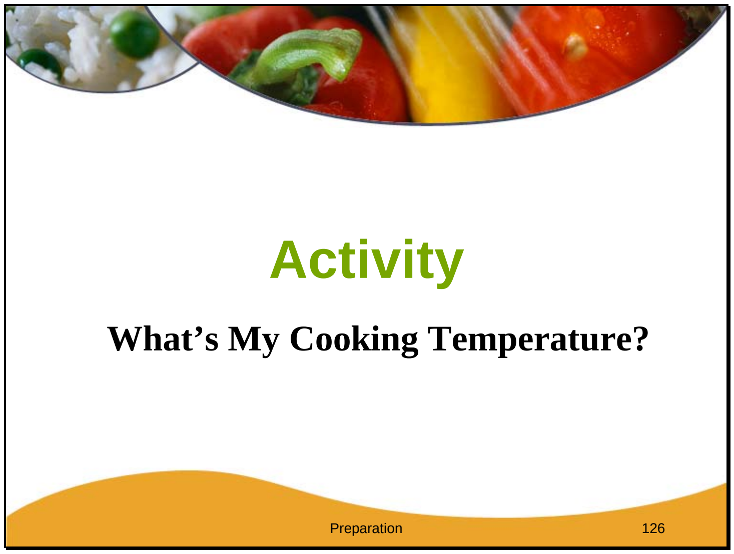
Slide 125



The rapid increase in food temperature resulting from microwave heating does not provide the same cumulative time and temperature relationship necessary for the destruction of microorganisms as do conventional cooking methods. In order to achieve comparable lethality, the food must attain a temperature of 74°C (165°F) in all parts of the food. Since cold spots may exist in food cooking in a microwave oven, it is critical to measure the food temperature at multiple sites when the food is removed from the oven and then allow the food to stand covered for two minutes post microwave heating to allow thermal equalization and exposure. Although some microwave ovens are designed and engineered to deliver energy more evenly to the food than others, the important factor is to measure and ensure that the final temperature reaches 74°C (165°F) throughout the food.

The factors that influence microwave thermal processes include many of the same factors that are important in conventional processes (mass of objects, shape of objects, specific heat and thermal conductivity, etc.). However, other factors are unique in affecting microwave heating, due to the nature of the electric field involved in causing molecular friction. These factors are exemplified by moisture and salt contents of foods, which play a far more important role in microwave than conventional heating.

Slide 126



ACTIVITY INSTRUCTIONS: Ask participants to identify the proper cooking temperature for each of the foods shown on following slides.

Slide 127

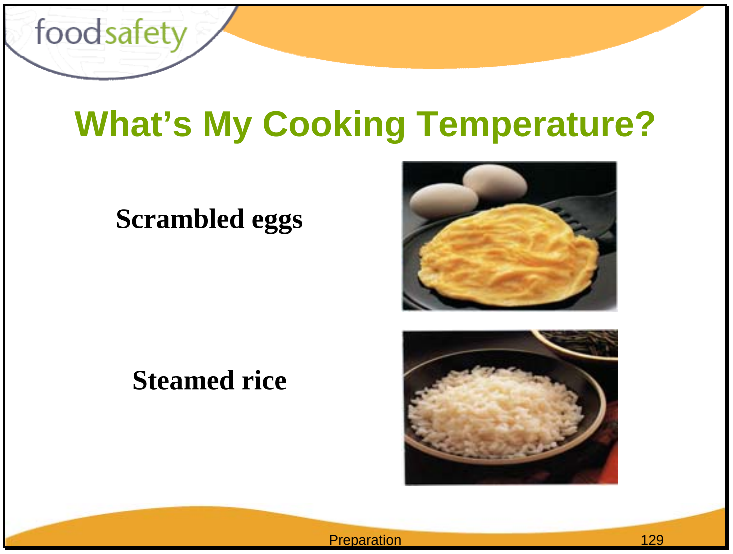
Beef hamburger – There are several time-temperature schedules that can be used to safely cook a ground beef hamburger. The most commonly cited is 155^{o}F or hotter for 15 seconds. However, a ground beef hamburger would be safe if it was cooked to 145^{o}F for 3 minutes; 150^{o}F for 1 minute; or 158^{o}F for <1 second (instantaneous).

Chicken breast – 165^{o}F or hotter for 15 seconds

Slide 128

Pork chop – 145°F or hotter for 15 seconds
Shrimp – 145°F or hotter for 15 seconds

Slide 129

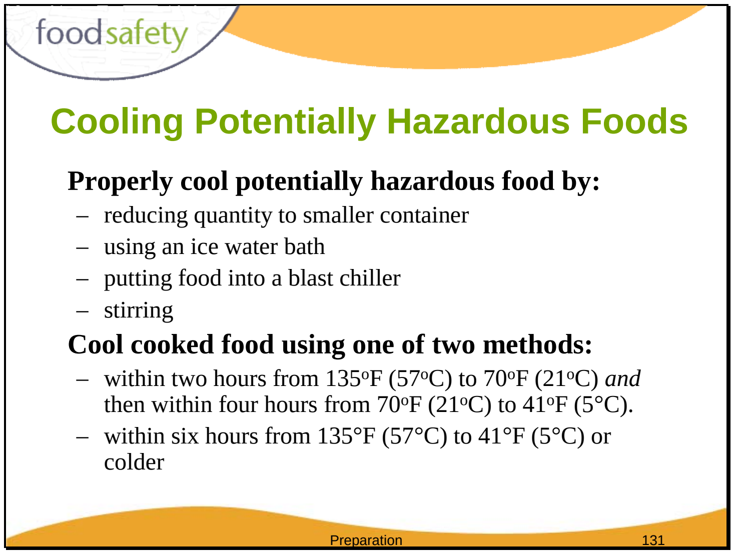


Scrambled eggs prepared for immediate service – 145°F or hotter for 15 seconds; *scrambled eggs for hot-holding* -- 145°F for 3 minutes, 150°F for 1 minute, or 158°F for less than 1 second.
Steamed rice – 135°F or hotter if it is cooked for hot holding. It can be cooked to any temperature if it is to be eaten immediately.

Slide 130

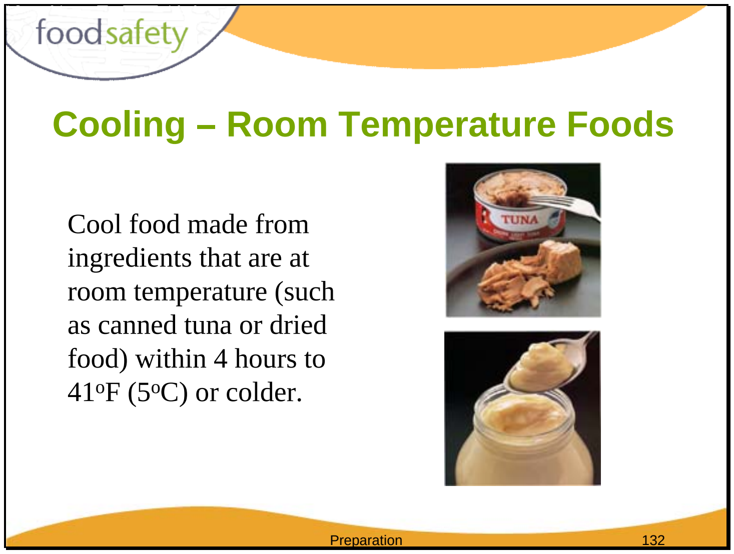
Fish sticks that are commercially processed – 135°F if to be hot-held; any temperature if cooked for immediate service.
Cheese pizza – 135°F if cooked for hot holding; any temperature if cooked for immediate service.

Slide 131



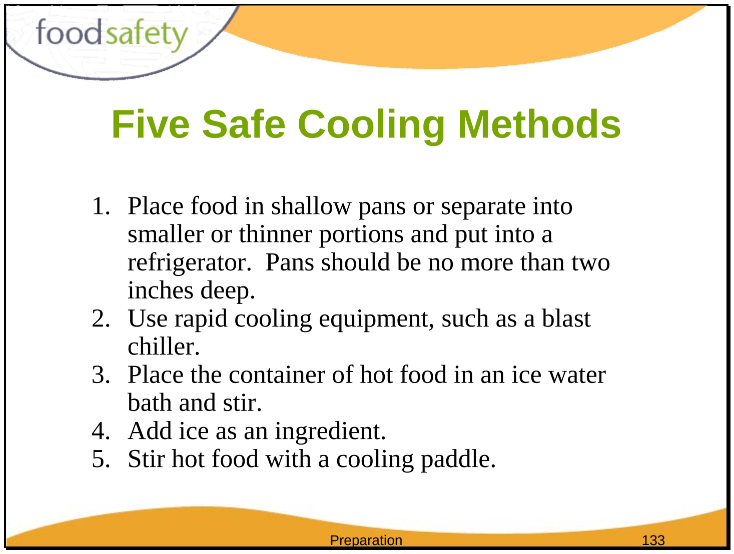
To prevent the growth and multiplication of spore-forming microorganisms, food should be cooled rapidly after cooking. When there is inadequate cooling, spores can germinate and the resulting vegetative cells can multiply to hazardous levels. The presence of sufficient numbers of *C. botulinum* or other spore-forming microorganisms may lead to production of harmful toxins. Therefore, ensuring no growth of these microorganisms will provide the greatest amount of safety.

Slide 132



A two-stage cooling method cannot be used because it is assumed that the initial temperature will be 70°F or colder. The guidelines require that once a food is at 70°F that it must be cooled to 41°F within four hours.

Slide 133



If food is held at improper temperatures for enough time, pathogenic bacteria have the opportunity to multiply to dangerous numbers. Proper reheating kills most pathogens of concern, except for bacterial spores. It is especially effective in reducing the numbers of *Clostridium perfringens* that may grow in meat, poultry, or gravy if these products were held at improper holding temperatures or improperly cooled. However, proper reheating will not necessarily destroyed bacterial toxins. For example, toxins such as that produced by the bacterium, *Staphylococcus aureus*, are heat-stable and so are destroyed only if the food is boiled for at least ten hours.

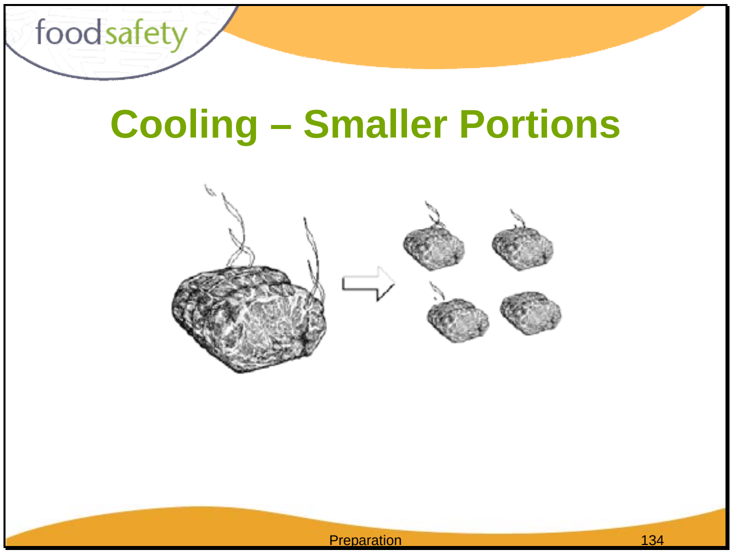
Pathogenic bacteria are more likely to grow in reheated cooked foods than they are in raw foods. This is because spoilage bacteria, which inhibit the growth of pathogens by competition on raw foods, are killed during cooking. Subsequent recontamination by pathogens will allow them to grow without competition from spoilage bacteria if temperature abuse occurs.

Safe cooling requires removing heat from food quickly enough to prevent microbial growth. Excessive time for cooling of potentially hazardous foods has been consistently identified as one of the leading contributing factors to foodborne illness. During slow cooling, potentially hazardous foods are subject to the growth of a variety of pathogenic microorganisms. A longer time near ideal bacterial incubation temperatures, 70°F-125°F, is to be avoided. If the food is not cooled properly, pathogens may grow to sufficient numbers to cause foodborne illness.

If the cooking step prior to cooling is adequate and no recontamination occurs, all but the spore-forming microorganisms such as *Clostridium perfringens or Bacillus cereus* should be killed or inactivated. However, under substandard sanitary conditions, other pathogens such as *Salmonella* or *Listeria monocytogenes* may be reintroduced. Thus, cooling requirements are based on the growth characteristics of specific microorganisms that may survive or be post-cooking contaminants that grow rapidly under temperature abuse conditions.

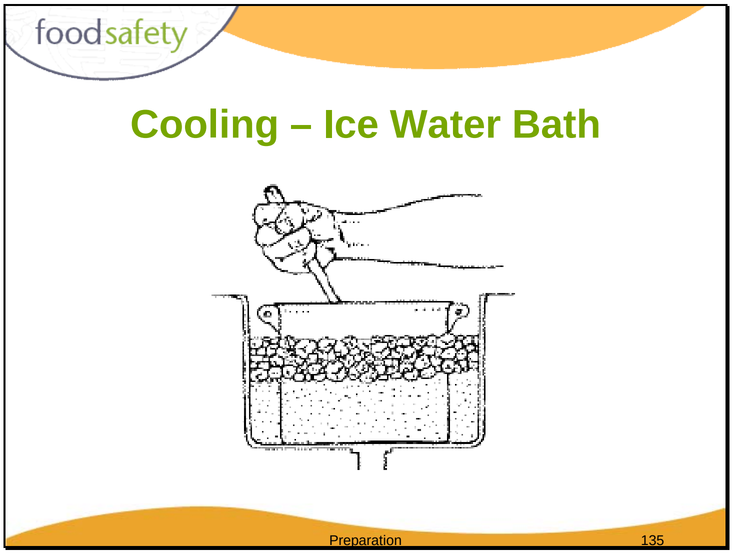
The processing of most ready-to-eat products includes a heat treatment or cooking step to eliminate pathogenic and spoilage microorganisms. However, this heat treatment does not eliminate spores of *Clostridium botulinum* and *Clostridium perfringens* and other spore-forming bacteria. Furthermore, these microorganisms can thrive in the warm product since other competing microorganisms have been eliminated. Non-refrigerated, anaerobic conditions are conducive to their growth and multiplication.

Slide 134



To cool a roast, it is best to cut the roast into individual serving sizes and place the smaller portions into a shallow pan to cool. The stacks should not be higher than two inches in the pan so that cooling is quick. Liquid foods should be placed into a container(s) that is(are) three inches in depth or into a container(s) to a level of three inches or less. Solid foods should be placed into a container(s) that is(are) two inches in depth or into a container(s) to a level of two inches or less.

Slide 135



An ice water bath is an acceptable way to cool hot foods down before putting into shallow pans.

Slide 136

Ice made from safe water can be added as an ingredient to quickly cool food.

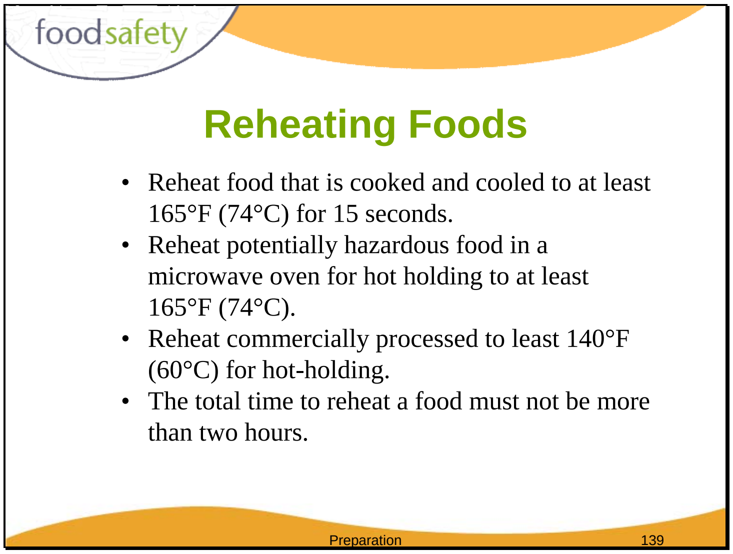
Slide 137

A blast cooler can be used to quickly cool hot food.

Slide 138

Stirring large pot of beef stew with an ice paddle

Slide 139



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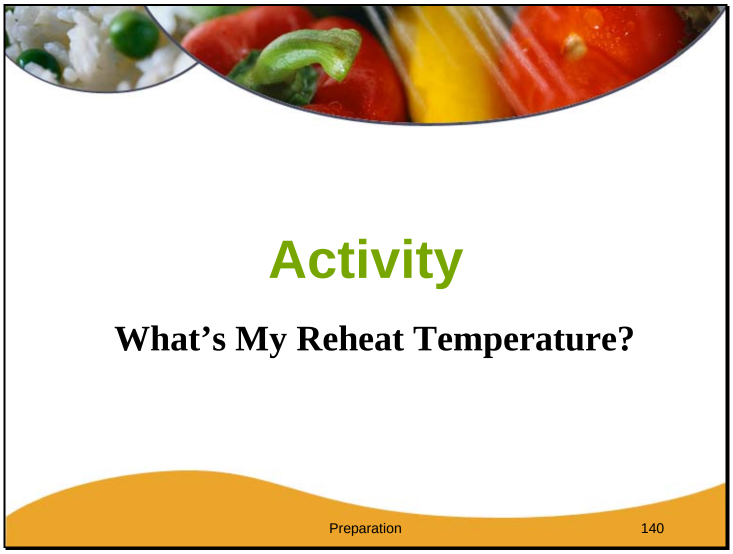
Slide 140



ACTIVITY INSTRUCTIONS: Have participants identify the proper reheating temperature for the foods shown on the following slides.

Slide 141

Any temperature unless it is to held hot. If to be hot-held, then it must be reheated to 135 degrees F or hotter.

Slide 142

Any temperature if for immediate service. If the beef stew is to be hot-held, then it must be reheated to 135°F or hotter.

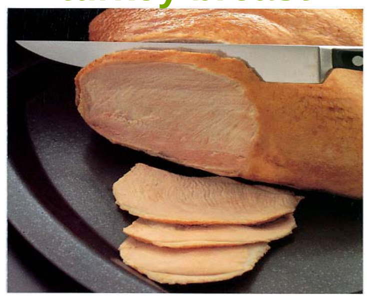
Slide 143

If the hot dog is heated for immediate service, then it can be heated to any temperature. If it is reheated and will be hot-held it must be reheated to 135°F or hotter. **NOTE:** Highly susceptible individuals should never even hot dogs or deli meats without thoroughly reheating them.

Slide 144

foodsafety

Commercially precooked turkey breast



Preparation 144

If the turkey is heated for immediate service, then it can be heated to any temperature. If it is reheated and will be hot-held it must be reheated to 135^{o}F or hotter.