



# 2

## Forms of Contamination



# Forms of Contamination

## Objectives:

By the end of this chapter, you should be able to identify the following:

- Biological, chemical, and physical contaminants and ways to prevent food from being contaminated by them
- How to prevent the deliberate contamination of food
- The correct response to a foodborne-illness outbreak
- The most common food allergens and how to prevent exposure to food allergens



# How Contamination Happens

## Contamination:

- Presence of harmful substances in food

## Contaminants can:

- Be biological, chemical, or physical
- Cause foodborne illness
- Result in physical injury



# How Contamination Happens

## Contaminants come from a variety of places:

- Animals we use for food
- Air, contaminated water, and dirt
- Chemicals we use in our operations
- Naturally occurring, such as fish bones
- People
  - Deliberately
  - Accidentally



# How Contamination Happens

## People can contaminate food when:

- They don't wash their hands after using the restroom.
- They are in contact with a person who is sick.
- They sneeze or vomit onto food or food contact surfaces.
- They touch dirty food-contact surfaces and equipment and then touch food.





# How Contamination Happens

## Simple mistakes can cause contamination:

- Allowing ready-to-eat food to touch a surface that contacted raw meat, seafood, or poultry
- Storing food or cleaning products incorrectly
- Failing to spot signs of pests





# Biological Contamination

## Microorganism:

- Small, living organism that can be seen only with a microscope

## Pathogen:

- Harmful microorganism
- Make people sick when eaten or produce toxins that cause illness

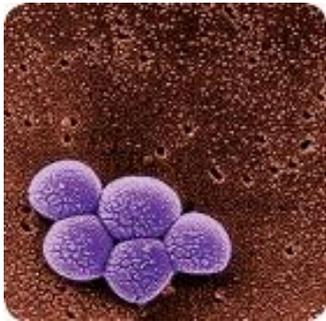
## Toxin:

- Poison

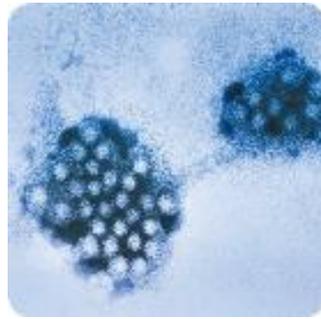


# Biological Contamination

Four types of pathogens can contaminate food and cause foodborne illness:



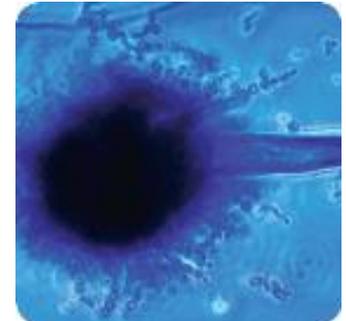
Bacteria



Viruses



Parasites



Fungi



# Biological Contamination

## The Big Six Pathogens:

- *Shigella* spp.
- *Salmonella* Typhi
- Nontyphoidal *Salmonella* (NTS)
- Shiga toxin-producing *Escherichia coli* (STEC), also known as *E. coli*
- Hepatitis A
- Norovirus



# Symptoms of Foodborne Illness

## Common symptoms of foodborne illness:

- Diarrhea
- Vomiting
- Fever
- Nausea
- Abdominal cramps
- Jaundice—a yellowing of the skin and eyes



## Onset times:

- Depend on the type of foodborne illness
- Can range from 30 minutes to six weeks



# Bacteria: Basic Characteristics

## Location:

- Found almost everywhere

## Detection:

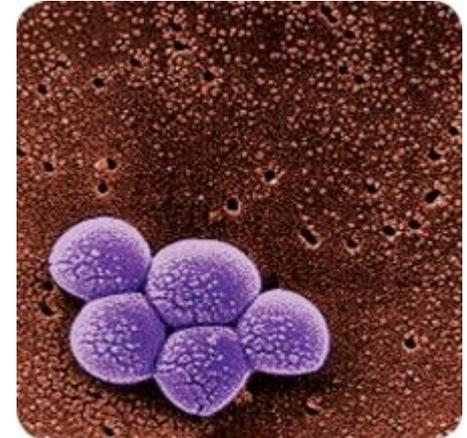
- Cannot be seen, smelled, or tasted

## Growth:

- Grow rapidly if FAT TOM conditions are correct

## Prevention:

- Control time and temperature



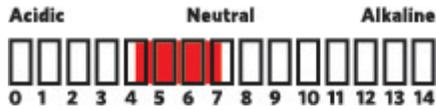


# Bacteria: Conditions for Growth



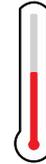
**F**

**Food**



**A**

**Acidity**



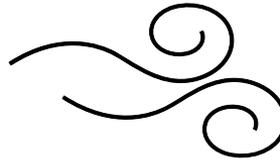
**T**

**Temperature**



**T**

**Time**



**O**

**Oxygen**



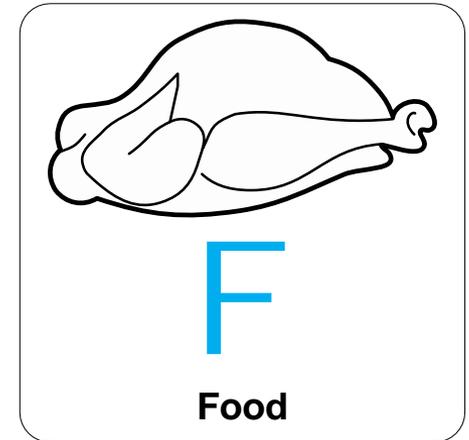
**M**

**Moisture**

# Bacteria: Conditions for Growth

## Food:

- Most bacteria need nutrients to survive.
- TCS food supports the growth of bacteria better than other types of food.

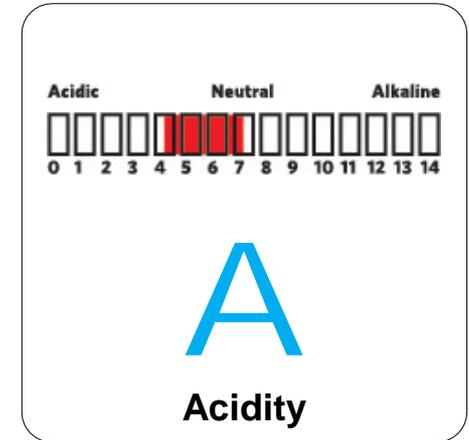




# Bacteria: Conditions for Growth

## Acidity:

- Bacteria grow best in food that contains little or no acid.

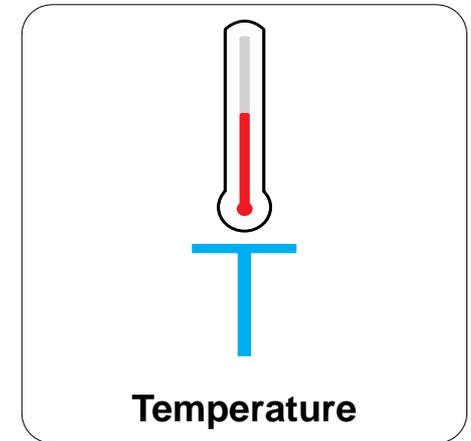




# Bacteria: Conditions for Growth

## Temperature:

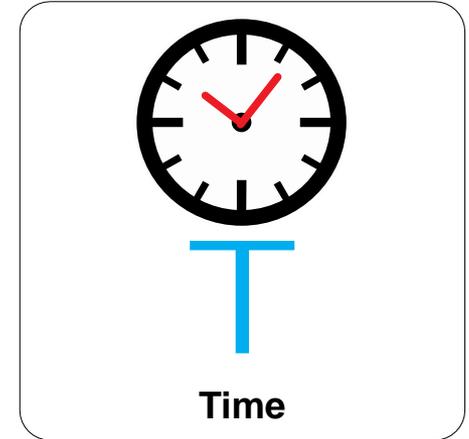
- Bacteria grow rapidly between 41°F and 135°F (5°C and 57°C).
  - This range is known as the temperature danger zone.
- Bacteria growth is limited when food is held above or below the temperature danger zone.



# Bacteria: Conditions for Growth

## Time:

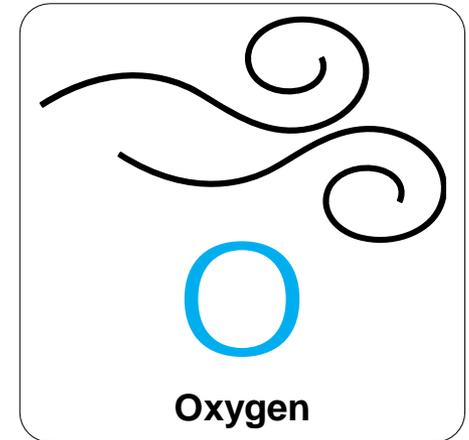
- Bacteria need time to grow.
- The more time bacteria spend in the temperature danger zone, the greater chance they have to grow to unsafe levels.



# Bacteria: Conditions for Growth

## Oxygen:

- Some bacteria need oxygen to grow.
- Other bacteria grow when oxygen isn't there.

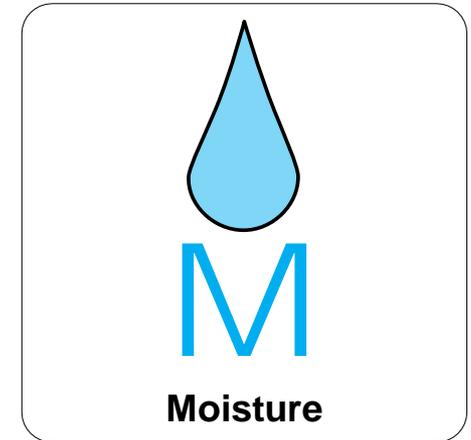




# Bacteria: Conditions for Growth

## Moisture:

- Bacteria grow well in food with high levels of moisture.
- $a_w$  = water activity; the amount of moisture available in food for bacterial growth.
- $a_w$  scale ranges from 0.0 to 1.0.
- Water has a water activity of 1.0.

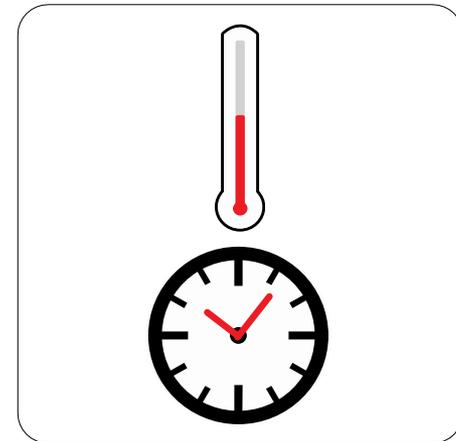




# Controlling FAT TOM Conditions

## The conditions you can control:

- Temperature
  - Keep TCS food out of the temperature danger zone.
- Time
  - Limit how long TCS food spends in the temperature danger zone.





# Major Bacteria That Cause Foodborne Illness

The FDA has identified four types of bacteria that cause severe illness and are highly contagious:

- *Salmonella* Typhi
- Nontyphoidal *Salmonella*
- *Shigella* spp.
- Shiga toxin-producing *E. coli* (STEC)

Food handlers with illnesses from these bacteria must not work in a foodservice operation while they are sick.



# Major Bacteria That Cause Foodborne Illness



**Bacteria:** *Salmonella* Typhi (SAL-me-NEL-uh TI-fee)  
**Source:** People

## Food Linked with the Bacteria

- Ready-to-eat food
- Beverages

## Prevention Measures

- Exclude from the operation food handlers diagnosed with an illness caused by *Salmonella* Typhi.
- Wash hands.
- Cook food to minimum internal temperatures.



# Major Bacteria That Cause Foodborne Illness



**Bacteria:** Nontyphoidal *Salmonella* (SAL-me-NEL-uh)  
**Source:** Farm animals, people

## Food Linked with the Bacteria

- Poultry and eggs
- Meat
- Milk and dairy products
- Produce

## Prevention Measures

- Cook poultry and eggs to minimum internal temperatures.
- Prevent cross-contamination between poultry and ready-to-eat food.
- Exclude from the operation food handlers who are vomiting or have diarrhea and have been diagnosed with an illness caused by nontyphoidal *Salmonella*.

# Major Bacteria That Cause Foodborne Illness



**Bacteria:** *Shigella* spp. (shi-GEL-uh)

**Source:** Human feces

## Food Linked with the Bacteria

- Food easily contaminated by hands, such as salads containing TCS food (potato, tuna, shrimp, macaroni, chicken)
- Food that has made contact with contaminated water, such as produce

## Prevention Measures

- Exclude from the operation food handlers who have diarrhea and have been diagnosed with an illness caused by *Shigella* spp.
- Wash hands.
- Control flies inside and outside the operation.

# Major Bacteria That Cause Foodborne Illness



**Bacteria:** Shiga toxin-producing *Escherichia coli* (ess-chur-EE-kee-UH KO-LI) (STEC), also known as *E. coli*

**Source:** Intestines of cattle; infected people

## Food Linked with the Bacteria

- Ground beef (raw and undercooked)
- Contaminated produce

## Prevention Measures

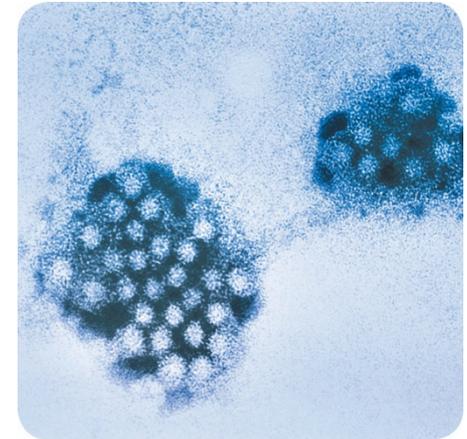
- Exclude from the operation food handlers who have diarrhea and have been diagnosed with a disease from the bacteria.
- Cook food, especially ground beef, to minimum internal temperatures.
- Purchase produce from approved, reputable suppliers.
- Prevent cross-contamination between raw meat and ready-to-eat food.



# Viruses: Basic Characteristics

## Location:

- Carried by human beings and animals
  - Require a living host to grow
  - Do not grow in food
  - Can be transferred through food and remain infectious in food



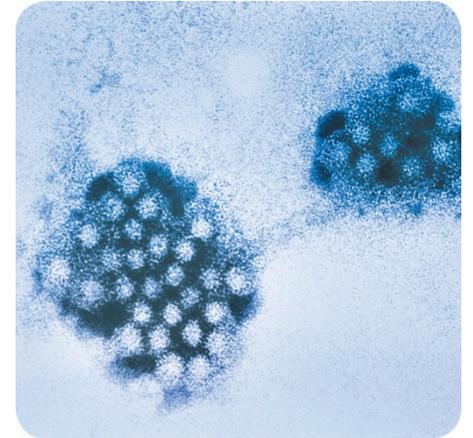
## Sources:

- Food, water, or any contaminated surface
- Typically occur through fecal-oral routes

# Viruses: Basic Characteristics

## Destruction:

- Not destroyed by normal cooking temperatures
- Good personal hygiene must be practiced when handling food and food-contact surfaces
- Quick removal and cleanup of vomit is important





# Major Viruses That Cause Foodborne Illnesses

The FDA has identified two viruses that are highly contagious and can cause severe illness:

- Hepatitis A
- Norovirus

Food handlers diagnosed with an illness from Hepatitis A or Norovirus must not work in an operation while they are sick.



# Major Viruses That Cause Foodborne Illness



**Virus:** Hepatitis A (HEP-a-TI-tiss)

**Source:** Human feces

## Food Linked with the Virus

- Ready-to-eat food
- Shellfish from contaminated water

## Prevention Measures

- Exclude from the operation staff who have been diagnosed with Hepatitis A.
- Exclude from the operation staff who have had jaundice for seven days or less.
- Wash hands.
- Avoid bare-hand contact with ready-to-eat food.
- Purchase shellfish from approved, reputable suppliers.



# Major Viruses That Cause Foodborne Illness



**Virus:** Norovirus (NOR-o-VI-rus)

**Source:** Human feces

## Food Linked with the Virus

- Ready-to-eat food
- Shellfish from contaminated water

## Prevention Measures

- Exclude from the operation staff who are vomiting or have diarrhea and have been diagnosed with Norovirus.
- Wash hands.
- Avoid bare-hand contact with ready-to-eat food.
- Purchase shellfish from approved, reputable suppliers.

# Parasites: Basic characteristics

## Location:

- Require a host to live and reproduce

## Source:

- Seafood, wild game, and food processed with contaminated water, such as produce



# Parasites: Basic characteristics

## Prevention:

- Purchase food from approved, reputable suppliers.
- Cook food to required minimum internal temperatures.
- Fish that will be served raw or undercooked must be correctly frozen by the manufacturer.





# Fungi: Basic Characteristics

## Yeasts, molds, and mushrooms:

- Some molds and mushrooms produce toxins.
- Throw out moldy food, unless mold is a natural part of the food.
- Purchase mushrooms from approved, reputable suppliers.





# Biological Toxins

## Origin:

- Naturally occur in certain plants, mushrooms, and seafood

## Seafood toxins:

- Produced by pathogens found on certain fish:
  - Tuna, bonito, mahimahi.
  - Histamine is produced when fish is time-temperature abused.
- Occur in certain fish that eat smaller fish that have consumed a toxin:
  - Barracuda, snapper, grouper, amberjack.
  - Ciguatera toxin is an example.



# Biological Toxins

## Illness:

- Symptoms and onset times vary with illness.
- People will experience illness within minutes.



# Biological Toxins

## General symptoms:

- Diarrhea or vomiting
- Neurological symptoms
  - Tingling in extremities
  - Reversal of hot and cold sensations
- Flushing of the face
- Difficulty breathing
- Burning in the mouth
- Heart palpitations
- Hives





# Biological Toxins

## Prevention:

- Purchase plants, mushrooms, and seafood from approved, reputable suppliers.
- Control time and temperature when handling raw fish.



# Chemical Contaminants

## Sources:

- Cleaners, sanitizers, polishes, machine lubricants, and pesticides
- Deodorizers, first-aid products, and health and beauty products
  - Hand lotions, hairsprays, etc.
- Certain types of kitchenware and equipment
  - Items made from pewter, copper, zinc, and some types of painted pottery





# Chemical Contaminants

## Symptoms:

- Vary depending on chemical consumed.
- Most illnesses occur within minutes.
- Vomiting and diarrhea are typical.

# Chemical Contaminants

## Prevention:

- Use chemicals approved for use in foodservice operations.
- Purchase chemicals from approved, reputable suppliers.
- Store chemicals away from prep areas, food-storage areas, and service areas.
  - Separate chemicals from food and food-contact surfaces by spacing and partitioning.
- **NEVER** store chemicals above food or food-contact surfaces.



# Chemical Contaminants

## Prevention:

- Use chemicals for their intended use and follow manufacturer's directions.
- Only handle food with equipment and utensils approved for foodservice use.
- Make sure the manufacturer's labels on original chemical containers are readable.
- Follow the manufacturer's directions and local regulatory requirements when throwing out chemicals.





# Physical Contaminants

## Sources:

- Common objects that get into food
  - Metal shavings from cans
  - Wood
  - Fingernails
  - Staples
  - Bandages
  - Glass
  - Jewelry
  - Dirt
- Naturally occurring objects such as fruit pits and bones



# Physical Contaminants

## Symptoms:

- Mild to fatal injuries
- Cuts, dental damage, and choking
- Bleeding and pain

## Prevention:

- Purchase food from approved, reputable suppliers.
- Closely inspect food received.
- Take steps to prevent physical contamination, including practicing good personal hygiene.



# Deliberate Contamination of Food

## Groups who may attempt to contaminate food:

- Terrorists or activists
- Disgruntled current or former staff
- Vendors
- Competitors

## FDA defense tool:

- A.L.E.R.T.



# Deliberate Contamination of Food

- A**ssure      Make sure products received are from safe sources.
- L**ook        Monitor the security of products in the facility.
- E**mployees    Know who is in your facility.
- R**eports      Keep information related to food defense accessible.
- T**hreat        Develop a plan for responding to suspicious activity or a threat to the operation.



# Responding to a Foodborne-Illness Outbreak

- Gather information.
- Notify authorities.
- Segregate product.
- Document information.
- Identify staff.
- Cooperate with authorities.
- Review procedures.



# Responding to a Foodborne-Illness Outbreak

- Gather information:
  - Ask the person for general contact information.
  - Ask the person to identify the food eaten.
  - Ask for a description of symptoms.
  - Ask when the person first got sick.
- Notify authorities:
  - Contact the local regulatory authority if an outbreak is suspected.





# Responding to a Foodborne-Illness Outbreak

- Segregate product:
  - Set the suspected product aside if any remains.
  - Include a label with “Do Not Use” and “Do Not Discard” on it.
- Document the information:
  - Log information about suspected product.
  - Include a product description, product date, lot number, sell-by date, and pack size.





# Responding to a Foodborne-Illness Outbreak

- Identify staff:
  - Keep a list of food handlers scheduled at the time of the incident.
  - Interview staff immediately.
- Cooperate with authorities:
  - Provide appropriate documentation.
- Review procedures:
  - Determine if standards are being met.
  - Identify if standards are not working.



# Food Allergens

## Food allergen:

- A protein in a food or ingredient some people are sensitive to.
- These proteins occur naturally.
- When an enough of an allergen is eaten, an allergic reaction can occur.



# Food Allergens

## Allergy symptoms:

- Nausea
- Wheezing or shortness of breath
- Hives or itchy rashes
- Swelling in various parts of the body, including the face, eyes, hands, or feet
- Vomiting and/or diarrhea
- Abdominal pain
- Itchy throat





# Food Allergens

## Allergic reactions:

- Symptoms can become serious quickly.
- A severe reaction, called anaphylaxis, can lead to death.





# Food Allergens

## Common Food Allergens—The Big Eight



Milk



Soy



Eggs



Wheat



Fish, such as bass, flounder, and cod



Crustacean shellfish, such as crab, lobster, and shrimp



Peanuts



Tree nuts, such as walnuts and pecans



# Preventing Allergic Reactions

## Food labels:

- Check food labels for allergens.

Calories per gram:  
Fat 9 • Carbohydrate 4 • Protein 4

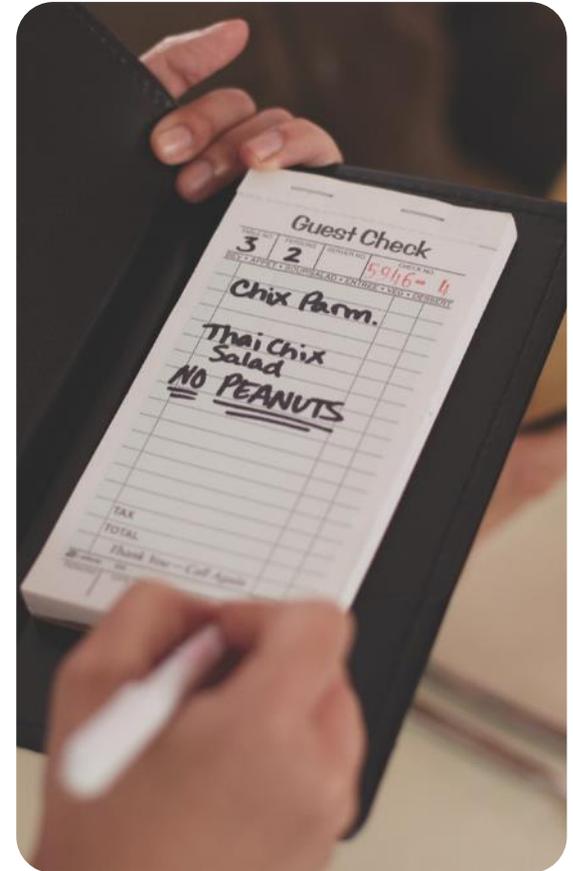
**INGREDIENTS:** CHICKEN BROTH, CONTAINS I  
OF THE FOLLOWING: SALT, DEXTROSE, C  
MONOSODIUM GLUTAMATE, HYDROLYZED W  
NATURAL FLAVORS, AUTOLYZED YEAST EXT  
JUICE CONCENTRATE, MONO AND DIGLYCERI  
GUM, ONION JUICE CONCENTRATE.

**CONTAINS: WHEAT.**

# Preventing Allergic Reactions

## Service staff:

- Describe menu items and preparation to guests.
- Identify any allergens in the item.
- Suggest menu items without the allergen.
- Clearly identify the guest's order for kitchen and service staff.
- Deliver food separately to prevent cross-contact.



# Preventing Allergic Reactions

## Kitchen staff:

- Avoid cross-contact
  - Do **NOT** cook different types of food in the same fryer oil.
  - Do **NOT** put food on surfaces that have touched allergens.



# Preventing Allergic Reactions

## How to avoid cross-contact:

- Check recipes and ingredient labels.
- Wash, rinse, and sanitize cookware, utensils, and equipment.
- Make sure the allergen doesn't touch anything for customers with food allergies.
- Wash your hands and change gloves before prepping food.
- Use separate fryers and cooking oils for guests with food allergies.
- Label food packaged on-site for retail use.

