Incorrectly Cleaned Yogurt Machine Makes Soldiers Sick

Several soldiers and their family members got sick at a military base in the northeastern United States. The victims had eaten frozen yogurt at a popular snack bar on the base. They suffered from vomiting, diarrhea, and chills. A child was admitted to the base hospital for severe dehydration.

An investigation showed that the yogurt machine was the culprit. It seems that food handlers at the snack bar did not break down the machine before cleaning it. They also failed to sanitize surfaces after cleaning them. This led to the outbreak. The local regulatory authority worked with the snack bar manager to put procedures in place to prevent any future incidents.

You Can Prevent This

In the story you just read, people got sick because the operation did not clean and sanitize equipment correctly. Cleaning and sanitizing food-contact surfaces can help you avoid foodborne-illness outbreaks. To do it correctly, you need to know about the following topics:

- The different methods of sanitizing and how to make sure they are effective
- How and when to clean and sanitize surfaces
- How to wash items in a dishwasher or a three-compartment sink and then store them
- How to use and store cleaning tools and supplies
- How to develop a cleaning program
Cleaning and Sanitizing

Food can easily be contaminated if you don’t keep your facility and equipment clean and sanitized. Cleaning removes food and other dirt from a surface. Sanitizing reduces pathogens on a surface to safe levels.

Cleaners

Cleaners must be stable, noncorrosive, and safe to use. Ask your supplier to help you pick cleaners that meet your needs. To use cleaners correctly, follow these guidelines.

- Follow manufacturers’ instructions carefully, as the manager in the photo at left is doing. If not used the correct way, cleaners may not work and can even be dangerous.

- Do not use one type of cleaner in place of another unless the intended use is the same.

Sanitizers

Food-contact surfaces must be sanitized after they have been cleaned and rinsed. This can be done by using heat or chemicals.

Heat Sanitizing

One way to sanitize items is to soak them in hot water. For this method to work, the water must be at least 171°F (77°C). The items must be soaked for at least 30 seconds. Another way to sanitize items is to run them through a high-temperature dishwasher.

Chemical Sanitizing

Tableware, utensils, and equipment can be sanitized by soaking them in a chemical sanitizing solution. Or you can rinse, swab, or spray them with sanitizing solution, as shown in the photo at left.

Three common types of chemical sanitizers are chlorine, iodine, and quaternary ammonium compounds, or quats. Chemical sanitizers are regulated by state and federal environmental protection agencies (EPAs). For requirements, check with your local regulatory authority.

In some cases, you can use detergent-sanitizer blends to sanitize. Operations that have two-compartment sinks often use these. If you use a detergent-sanitizer blend, use it once to clean. Then use it a second time to sanitize.
Sanitizer Effectiveness

Several factors influence the effectiveness of chemical sanitizers. The most critical include concentration, temperature, contact time, water hardness, and pH.

**Concentration** Sanitizer solution is a mix of chemical sanitizer and water. The concentration of this mix—the amount of sanitizer to water—is critical. Too little sanitizer may make the solution weak and useless. Too much sanitizer may make the solution too strong and unsafe. It can also leave a bad taste on items or corrode metal.

Concentration is measured in parts per million (ppm). To check the concentration of a sanitizer solution, use a test kit, as shown in the photo at left. Make sure it is made for the sanitizer being used. These kits are usually available from the chemical manufacturer or supplier.

Hard water, food bits, and leftover detergent can reduce the solution’s effectiveness. Change the solution when it looks dirty or its concentration is too low. Check the concentration often.

**Temperature** The water in sanitizing solution must be the correct temperature. Follow manufacturers’ recommendations.

**Contact time** For a sanitizer solution to kill pathogens, it must make contact with the object being sanitized for a specific amount of time. The basin in the photo at left is being sanitized in an iodine sanitizing solution. It must be in contact with the solution for at least 30 seconds.

**Water hardness** Water hardness can affect how well a sanitizer works. Water hardness is the amount of minerals in your water. Find out what your water hardness is from your municipality. Then work with your supplier to identify the correct amount of sanitizer to use for your water.

**pH** Water pH can also affect a sanitizer. Find out what the pH of your water is from your municipality. Then work with your supplier to find out the correct amount of sanitizer to use for your water.

<table>
<thead>
<tr>
<th>General Guidelines for the Effective Use of Chlorine, Iodine, and Quats</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Chlorine</strong></td>
</tr>
<tr>
<td><strong>Water temperature</strong></td>
</tr>
<tr>
<td><strong>Water pH</strong></td>
</tr>
<tr>
<td><strong>Water hardness</strong></td>
</tr>
<tr>
<td><strong>Sanitizer concentration</strong></td>
</tr>
<tr>
<td><strong>Sanitizer contact time</strong></td>
</tr>
</tbody>
</table>
How and When to Clean and Sanitize

All surfaces must be cleaned and rinsed. This includes walls, storage shelves, and garbage containers. However, any surface that touches food, such as knives, stockpots, cutting boards, or prep tables, must be cleaned and sanitized.

To clean and sanitize a surface, follow these steps.

1. Scrape or remove food bits from the surface.
   - Use the correct cleaning tool, such as a nylon brush or pad, or a cloth towel.

2. Wash the surface.
   - Prepare the cleaning solution with an approved cleaner.
   - Wash the surface with the correct cleaning tool, such as a cloth towel.

3. Rinse the surface.
   - Use clean water.
   - Rinse the surface with the correct cleaning tool, such as a cloth towel.

4. Sanitize the surface.
   - Use the correct sanitizing solution.
   - Prepare the concentration per manufacturer requirements.
   - Use the correct tool, such as a cloth towel, to sanitize the surface.
   - Make sure the entire surface has come in contact with the sanitizing solution.

5. Allow the surface to air-dry.
When to clean and sanitize  All food-contact surfaces need to be cleaned and sanitized at these times.

- After they are used
- Before food handlers start working with a different type of food
- Any time food handlers are interrupted during a task and the items being used may have been contaminated
- After four hours if items are in constant use

Cleaning and Sanitizing Stationary Equipment

Equipment manufacturers will usually provide instructions for cleaning and sanitizing stationary equipment, such as a slicer. In general, follow these steps.

- Unplug the equipment.
- Take the removable parts off the equipment. Wash, rinse, and sanitize them by hand. You can also run the parts through a dishwasher if allowed.
- Scrape or remove food from the equipment surfaces.
- Wash the equipment surfaces. Use a cleaning solution prepared with an approved cleaner. Wash the equipment with the correct cleaning tool, such as a nylon brush or pad, or a cloth towel.
- Rinse the equipment surfaces with clean water. Use a cloth towel or other correct tool.
- Sanitize the equipment surfaces as the food handler in the photo at left is doing. Make sure the sanitizer comes in contact with each surface. The concentration of the sanitizer must meet requirements.
- Allow all surfaces to air-dry. Put the unit back together.

Clean-in-Place Equipment

Some pieces of equipment, such as soft-serve yogurt machines, are designed to have cleaning and sanitizing solutions pumped through them. Since many of them hold and dispense TCS food, they must be cleaned and sanitized every day unless otherwise indicated by the manufacturer. You should also check your local regulatory requirements.
Apply Your Knowledge

Was It Sanitized?
Circle the correct answer for each question. For all situations, assume water hardness and pH are at the correct level.

1. Lee mixed a quats sanitizer with 75°F (24°C) water. A test kit showed the concentration was correct according to the manufacturer's recommendations. He soaked some utensils in the solution for 30 seconds. Were the utensils sanitized correctly?  Yes  No

2. Josh mixed a chlorine sanitizer with 75°F (24°C) water. A test kit showed the concentration was 25 ppm. He soaked some tableware in the solution for 7 seconds. Was the tableware sanitized correctly?  Yes  No

3. Cecelia mixed an iodine sanitizer with 68°F (20°C) water. A test kit showed the concentration was 8 ppm. She put a pan in the solution for 30 seconds. Was the pan sanitized correctly?  Yes  No

4. Jarmin mixed a chlorine sanitizer with 100°F (38°C) water. A test kit showed the concentration was 50 ppm. She put a bowl in the solution for 7 seconds. Was the bowl sanitized correctly?  Yes  No

Take the Correct Steps
Put the steps for cleaning and sanitizing in order by writing the number of the step in the space provided.

A. Sanitize the surface.
B. Clean the surface.
C. Allow the surface to air-dry.
D. Rinse the surface.
E. Remove food from the surface.

To Sanitize or Not to Sanitize
Write an X next to each situation that requires the food handler to clean and sanitize the item being used.

1. Jorge has used the same knife to shuck oysters for 2 hours.
2. Bill finishes deboning chicken and wants to use the same cutting board to fillet fish.
3. Mary returns to the slicer to continue slicing ham after being called away to help with the lunch rush.
4. Maria has been slicing cheese on the same slicer from 8:00 a.m. to 12:00 p.m.

For answers, please turn to page 10.21.
Dishwashing

Tableware and utensils are often cleaned and sanitized in a dishwashing machine. Larger items such as pots and pans are often cleaned by hand in a three-compartment sink. Whichever method you use, you must follow specific practices so items are cleaned and sanitized. Then you must make sure you store the items so they do not become contaminated.

Machine Dishwashing

Dishwashing machines sanitize by using either hot water or a chemical sanitizing solution.

High-Temperature Machines

High-temperature machines use hot water to clean and sanitize. If the water is not hot enough, items will not be sanitized. Extremely hot water can also bake food onto the items.

The temperature of the final sanitizing rinse must be at least 180°F (82°C), as shown in the photo at left. For stationary rack, single-temperature machines, it must be at least 165°F (74°C). The dishwasher must have a built-in thermometer that checks water temperature at the manifold, as shown in the photo at left. This is where the water sprays into the tank.

Chemical-Sanitizing Machines

Chemical-sanitizing machines can clean and sanitize items at much lower temperatures. Follow the dishwasher manufacturer’s guidelines.
Dishwasher Operation

Operate your dishwasher according to the manufacturer's recommendations, and keep it in good repair. However, no matter what type of machine you use, you should follow these guidelines.

Keeping the machine clean  Clean the machine as often as needed, checking it at least once a day. Clear spray nozzles of food and foreign objects. Remove mineral deposits when needed. Fill tanks with clean water, and make sure detergent and sanitizer dispensers are filled.

Preparing items for cleaning  Scrape, rinse, or soak items before washing. Presoak items with dried-on food.

Loading dish racks  Use the correct dish racks. Load them so the water spray will reach all surfaces, as shown in the photo at left. NEVER overload dish racks.

Drying items  Air-dry all items. NEVER use a towel to dry items. You could recontaminate them.

Monitoring  Check water temperature, pressure, and sanitizing levels. Take appropriate corrective action if necessary. Use heat tape or test strips to monitor the temperature of the sanitizing rinse. You can also use a maximum registering thermometer to do it.

Manual Dishwashing

Operations often use a three-compartment sink to clean and sanitize large items. The sink must be set up correctly before use, as shown in the photo at left.

- Clean and sanitize each sink and drain board.
- Fill the first sink with detergent and water. The water temperature must be at least 110°F (43°C). Follow manufacturer's recommendations.
- Fill the second sink with clean water. This is not necessary if items will be spray-rinsed instead of being dipped.
- Fill the third sink with water and sanitizer to the correct concentration. Hot water can be used as an alternative. Follow the guidelines on pages 10.2 through 10.3 and manufacturer's recommendations.
- Provide a clock with a second hand. This will let food handlers time how long items have been in the sanitizer.
How to Clean and Sanitize in a Three-Compartment Sink

Follow these steps to clean and sanitize items in a three-compartment sink.

1. Rinse, scrape, or soak items before washing them.

   If items are being soaked in the first sink, change the solution when food bits start to build up or the suds are gone.

2. Wash items in the first sink.

   Use a brush, cloth towel, or nylon scrub pad to loosen dirt. Change the water and detergent when the suds are gone or the water is dirty.

3. Rinse items in the second sink.

   Spray the items with water or dip them in it. Make sure to remove all traces of food and detergent from the items being rinsed. If dipping the items, change the rinse water when it becomes dirty or full of suds.

4. Sanitize items in the third sink.

   Change the sanitizing solution when the temperature of the water or the sanitizer concentration falls below requirements. **NEVER** rinse items after sanitizing them. This could contaminate their surfaces. The only exception to this rule is when you are washing items in a dishwasher that can safely rinse items after they have been sanitized.

5. Air-dry items on a clean and sanitized surface.

   Place items upside down so they will drain.
Storing Tableware and Equipment
Once utensils, tableware, and equipment have been cleaned and sanitized, they must be stored in a way that will protect them from contamination. Follow these guidelines.

Storage  Store tableware and utensils at least six inches (15 centimeters) off the floor. Protect them from dirt and moisture.

Storage surfaces  Clean and sanitize drawers and shelves before storing clean items.

Glasses and flatware  Store glasses and cups upside down on a clean and sanitized shelf or rack. Store flatware and utensils with handles up, as shown in the photo at left. Staff can then pick them up without touching food-contact surfaces, which will help prevent the transfer of pathogens such as Norovirus.

Trays and carts  Clean and sanitize trays and carts used to carry clean tableware and utensils. Check them daily, and clean as often as needed.

Stationary equipment  Keep the food-contact surfaces of stationary equipment covered until ready for use.

Apply Your Knowledge
The New Dishwasher
On a separate sheet of paper, list the missing or wrong steps in the story below.

Evan started work just as the breakfast rush had begun. A load of dirty dishes had just been put into the new dishwasher. There already were a lot of pots and pans to wash in the three-compartment sink, so Evan quickly got started. He scraped the dishes into a garbage container and stacked them on the drain board next to the first sink compartment. Then he filled the first compartment with hot water and added dish detergent. He put several pans in the soapy water to soak.

Next, Evan filled the remaining two compartments with warm water. He added iodine sanitizer to the third compartment. He used a thermometer to check the water temperature and then a test kit to check the sanitizer concentration. Both were good.

Using a nylon scrub pad, Evan worked on the pans until they were clean. As he finished each one, he dipped it in the sanitizing solution. Since customers had complained of an iodine flavor on tableware, he wanted to make sure there was no sanitizer left on the pans. As he pulled each pan out of the sanitizer, he placed it into the rinse water to soak for a few seconds. Then he put it on the clean drain board to air-dry.

What did Evan do wrong?

For answers, please turn to page 10.21.
Apply Your Knowledge

Mary’s Dilemma

Mary noticed that the dirty dishes had started to pile up. She quickly unloaded the dishwashing machine and got a dish cart. Mary saw a few crumbs on the cart. To clean it, she dipped a cloth towel in the dishwater in her three-compartment sink and wiped off the crumbs.

In the meantime, the carts of dirty dishes had grown. Mary quickly loaded a dish rack with as many dishes as she could fit into it. She glanced into the dishwasher before pushing in the rack. She noticed a heavy buildup of mineral deposits on the spray arm and inside the compartment. She closed the door and started the load.

What did Mary do wrong?

What’s Wrong with This Picture?

There are several things wrong with this three-compartment sink. Identify as many as you can in the space provided.

For answers, please turn to page 10.21.
Cleaning and Sanitizing in the Operation

Keeping your operation clean means using the correct tools, supplies, and storage to prevent contamination. Many of the chemicals you will use are hazardous, so you also have to know how to handle them to prevent injury.

For all of your cleaning efforts to come together, you need a master cleaning schedule. Making this schedule work also means training and monitoring your staff to be sure they can follow it.

Cleaning the Premises

Nonfood-contact surfaces must be cleaned regularly. Examples include floors, ceilings, equipment exteriors, restrooms, and walls, as shown in the photo at left. Regular cleaning prevents dust, dirt, and food residue from building up.

Cleaning Up After People Who Get Sick

If a person has diarrhea or vomits in the operation, these spills must be cleaned up the correct way. Vomit and diarrhea can carry Norovirus, which is highly contagious. Correct cleanup can prevent food from becoming contaminated. It will also keep others from getting sick.

The way you clean up these substances is different from the way you clean other items in the operation. There are several things to think about when developing a plan for cleaning up vomit and diarrhea.

- How you will contain liquid and airborne substances, and remove them from the operation
- How you will clean, sanitize, and disinfect surfaces
- When to throw away food that may have been contaminated
- What equipment is needed to clean up these substances, and how it will be cleaned and disinfected after use
- When a food handler must wear personal protective equipment
- How staff will be notified of the correct procedures for containing, cleaning, and disinfecting these substances
- How to segregate contaminated areas from other areas
- When staff must be restricted from working with or around food or excluded from working in the operation
- How sick customers will be quickly removed from the operation
- How the cleaning plan will be implemented
Cleaning Tools and Supplies

Your staff needs many tools and supplies to keep the operation clean. However, these items can contaminate food and surfaces if they are not used and stored correctly.

Storing Cleaning Tools and Supplies

Cleaning tools and chemicals must be stored in a separate area away from food and prep areas. The storage area should have the following:

- Good lighting so staff can see chemicals easily
- Hooks for hanging mops, brooms, and other cleaning tools
- Utility sink for filling buckets and washing cleaning tools
- Floor drain for dumping dirty water, as shown in the photo at left

To prevent contamination, **NEVER** clean mops, brushes, or other tools in sinks used for handwashing, food prep, or dishwashing. Additionally, **NEVER** dump mop water or other liquid waste into toilets or urinals.

When storing cleaning tools, consider the following:

- Air-dry towels overnight.
- Hang mops, brooms, and brushes on hooks to air-dry.
- Clean and rinse buckets. Let them air-dry, and then store them with other tools.
Using Foodservice Chemicals

Many of the chemicals used in the operation can be hazardous, especially if they are used the wrong way. To reduce your risk, you should only use chemicals that are approved for use in a foodservice operation. You should also follow these guidelines.

Storage and labeling  Store chemicals in their original containers away from food and prep areas, as shown in the photo at left. Separate by spacing or partitioning. If chemicals are transferred to a new container, the label on that container must list the common name of the chemical.

Disposal  When throwing out chemicals, follow the instructions on the label and any requirements from your local regulatory authority.

Material Safety Data Sheets  The Occupational Safety and Health Administration (OSHA) has requirements for using chemicals. OSHA requires chemical manufacturers and suppliers to provide a Material Safety Data Sheet (MSDS) for each hazardous chemical they sell. An MSDS contains the following information about the chemical:
  - Safe use and handling
  - Physical, health, fire, and reactivity hazards
  - Precautions
  - Appropriate personal protective equipment (PPE) to wear when using the chemical
  - First-aid information and steps to take in an emergency
  - Manufacturer’s name, address, and phone number
  - Preparation date of MSDS
  - Hazardous ingredients and identity information

MSDS are often sent with the chemical shipment. You can also request them from your supplier or the manufacturer. Staff have a right to see an MSDS for any hazardous chemical they work with. Therefore, you must keep these sheets where they can be accessed. The photo at left shows how one operation makes them available to staff.
Developing a Cleaning Program
To develop an effective cleaning program for your operation, you must focus on three things.

1. Creating a master cleaning schedule
2. Training your staff to follow it
3. Monitoring the program to make sure it works

Creating a Master Cleaning Schedule
Create a master cleaning schedule with the following information.

What should be cleaned   List all cleaning jobs in one area. Or list jobs in the order they should be performed.

Who should clean it   Assign each task to a specific individual.

When it should be cleaned   Staff should clean and sanitize as needed. Schedule major cleaning when food will not be contaminated or service will not be affected. Schedule work shifts for enough time.

How it should be cleaned   Have clear, written procedures for cleaning. List cleaning tools and chemicals by name. Post cleaning instructions near the item, as shown in the photo at left. Always follow manufacturers’ instructions when cleaning equipment.

Training Your Staff to Follow the Program
Schedule time for training. Work with small groups or conduct training by area.

Monitoring the Cleaning Program
Make sure the cleaning program is working.

- Supervise daily cleaning routines.
- Check all cleaning tasks against the master schedule every day.
- Change the master schedule as needed for any changes in menu, procedures, or equipment.
- Ask staff during meetings for input on the program.
Apply Your Knowledge

Is It Stored Correctly?
Write an X next to the situation if the food handler stored the cleaning tool or material the correct way.

1. _______ Sheryl received a shipment of cleaning supplies. Along with the invoice, the supplier gave her an MSDS for the new brand of cleaner she ordered. She filed the MSDS with the invoice in a locked cabinet.

2. _____ Raul noticed that a bottle of chemical cleaner in the storage area was leaking. Fortunately, there was a nearly empty spray bottle of the same cleaner, so he poured the remainder into it. The label on the spray bottle listed the common name of the chemical.

3. _____ Sasha emptied a bucket of dirty mop water into the floor drain in the chemical-storage room. He rinsed the mop and hung it to dry. Then he cleaned and rinsed the bucket.

4. ____ Laura washed and rinsed a prep table. Then she sanitized the table by spraying it with sanitizer and allowed it to air-dry. When she was finished, she placed the bottle of sanitizer on the prep table so it would be there the next time she needed it.

5. ____ Maurice used a cleaner on the dishwasher. The sprayer on the bottle stopped working when it was only half empty, so he threw it in the garbage.

What’s Wrong with This Picture?
There are many things wrong with this storage area. Identify as many as you can in the space provided.

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For answers, please turn to page 10.22.
Chapter Summary

- Cleaning removes food and other dirt from a surface. Sanitizing reduces the number of harmful pathogens on a surface to safe levels. You must clean and rinse a surface before it can be sanitized. Then the surface must be allowed to air-dry. Surfaces can be sanitized with hot water or a chemical-sanitizing solution.

- All surfaces should be cleaned and rinsed. Food-contact surfaces must be cleaned and sanitized after every use. You should also clean and sanitize each time you begin working with a different type of food or when a task is interrupted. If items are in constant use, they must be cleaned and sanitized every four hours.

- Tableware and utensils can be washed in dishwashers or by hand in a three-compartment sink. Always follow manufacturers' instructions when using dishwashers. Make sure your machine is clean and in good working condition. Check the temperature and pressure of wash-and-rinse cycles daily.

- Three-compartment sinks and drain boards must be cleaned and sanitized before they are used for dish washing. Items washed in a three-compartment sink should be rinsed or scraped clean before washing. They should then be washed in a detergent solution and rinsed in clean water. Next, they should be sanitized in either hot water or in a chemical-sanitizing solution for a specific amount of time. Finally, they should be air-dried. Once cleaned and sanitized, tableware and equipment should be protected from contamination.

- Make sure chemicals are clearly labeled. Keep MSDS for each chemical in a location accessible to all staff while on the job.

- Create a master cleaning schedule listing all cleaning tasks. Monitor the cleaning program to keep it effective and supervise cleaning procedures. Make adjustments as needed.
Chapter Review Case Study

Keeping a clean and sanitized operation involves using the correct tools and products for a cleaning job; cleaning and sanitizing items the correct way at the right time; storing items so they remain safe to use; handling chemicals the correct way; and developing and following a cleaning program.

Now, take what you have learned in this chapter and apply it to the following case study.

Tom was just hired as the new general manager at the Twin Trees Family Restaurant. One of his first projects was to create a new cleaning program. He started by taking a walk through the operation. His first stop was the storage area for cleaning tools and supplies. It had a utility sink and a floor drain, but the hot water in the sink wasn’t working. He also noticed two sets of mops and brooms stored on the floor. The storage area was small, but it was well organized and well lit. All the containers were clearly labeled.

1. Should Tom suggest any changes to the storage room, tools, or chemicals?

Yes _____ No _____ If yes, what changes should he suggest?

________________________________________________________________________

Next, Tom watched Clara, a new prep cook, to see how she cleaned and sanitized her areas. Clara cut some melons on a cutting board. Then she wiped it down with a cloth towel. Clara put the cloth towel in a bucket of sanitizing solution to soak while she butterflied some pork chops on the board. Using the same cloth towel, she wiped down the board after she finished the pork chops. Then, she chopped some onions and sautéed them in a large stock pot. While the onions were sautéing, Clara wiped the board a third time with the same cloth towel.

2. Did Clara do anything wrong?

Yes _____ No _____ If yes, what changes should he suggest?

________________________________________________________________________

Tom also watched many other staff members perform cleaning and sanitizing tasks that week. With the help of some senior staff, Tom created a master cleaning schedule.

3. What steps should Tom take to make sure everyone follows the master cleaning schedule?

________________________________________________________________________

For answers, please turn to page 10.22.
Study Questions

Circle the best answer to each question.

1. Which thermometer should be used to monitor the temperature of the sanitizing rinse in a dishwashing machine?
   A. Glass
   B. Infrared
   C. Bimetallic stemmed
   D. Maximum registering

2. What is sanitizing?
   A. Reducing dirt from a surface
   B. Reducing the pH of a surface
   C. Reducing the hardness of water
   D. Reducing pathogens to safe levels

3. If food-contact surfaces are in constant use, how often must they be cleaned and sanitized?
   A. Every 4 hours
   B. Every 5 hours
   C. Every 6 hours
   D. Every 7 hours

4. What must food handlers do to make sure sanitizing solution for use on food-contact surfaces has been made correctly?
   A. Test the solution with a sanitizer kit.
   B. Use very hot water when making the solution.
   C. Try out the solution on a food-contact surface.
   D. Mix the solution with equal parts of water.

5. A food handler was assigned to clean a slicer that was too difficult to move. The slicer was unplugged. Then the removable parts were taken off the slicer and cleaned and sanitized in a three-compartment sink. Food bits on the slicer were removed. After the machine was wiped down with detergent and water, it was sanitized and allowed to air-dry. Then the food handler put the machine back together. What mistake did the food handler make?
   A. Failed to dry the machine with a clean cloth after sanitizing it
   B. Failed to sanitize the machine before taking the removable parts off
   C. Failed to rinse the machine after wiping it down with detergent and water
   D. Failed to wash the machine with detergent and water before taking it apart

Continued on the next page ➤
Continued from previous page

6 What should be done when throwing away chemicals?
   A Seal the container and recycle it.
   B Seal the container in a bag and place it in the garbage.
   C Follow label instructions and regulatory requirements.
   D Pour leftover chemicals into a drain and throw the container away.

7 How should flatware and utensils that have been cleaned and sanitized be stored?
   A With handles facing up
   B Below cleaning supplies
   C In drawers that have been washed and rinsed
   D Four inches (10 centimeters) from the floor

5 What is the correct way to clean and sanitize a prep table?
   A Remove food from the surface, wash, rinse, sanitize, air-dry
   B Remove food from the surface, sanitize, rinse, wash, air-dry
   C Remove food from the surface, wash, sanitize, air-dry, rinse
   D Remove food from the surface, air-dry, wash, rinse, sanitize

For answers, please turn to page 10.22.
# Organisms That Cause Foodborne Illness

**Bacteria**

**Bacteria**  *Bacillus cereus* *(ba-SIL-us SEER-ee-us)*

**Illness**  *Bacillus cereus* gastroenteritis *(ba-SIL-us SEER-ee-us GAS-tro-EN-ter-I-tiss)*

*Bacillus cereus* is a spore-forming bacteria found in dirt. It can produce two different toxins when allowed to grow to high levels. The toxins cause different illnesses.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Bacteria</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea illness</td>
<td>Diarrhea illness</td>
<td>• Cook food to minimum internal temperatures.</td>
</tr>
<tr>
<td>• Cooked vegetables</td>
<td>• Watery diarrhea</td>
<td>• Hold food at the correct temperatures.</td>
</tr>
<tr>
<td>• Meat products</td>
<td>• No vomiting</td>
<td>• Cool food correctly.</td>
</tr>
<tr>
<td>• Milk</td>
<td><em>Vomiting illness</em></td>
<td>• Control time and temperature.</td>
</tr>
<tr>
<td><em>Vomiting illness</em></td>
<td>• Nausea</td>
<td></td>
</tr>
<tr>
<td>• Cooked rice dishes, including fried rice and rice pudding</td>
<td>• Vomiting</td>
<td></td>
</tr>
</tbody>
</table>

**Bacteria**  *Listeria monocytogenes* *(liss-TEER-ee-uh MON-a-SI-TAHJ-uh-neez)*

**Illness**  *Listeriosis* *(liss-TEER-ee-O-sis)*

*Listeria monocytogenes* is found in dirt, water, and plants. Unlike other bacteria, it grows in cool, moist environments. The illness is uncommon in healthy people, but high-risk populations are especially vulnerable—particularly pregnant women.

<table>
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<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Raw meat</td>
<td><em>Pregnant women</em></td>
<td>• Throw out any product that has passed its use-by or expiration date.</td>
</tr>
<tr>
<td>• Unpasteurized dairy products</td>
<td><em>Miscarriage</em></td>
<td>• Cook raw meat to minimum internal temperatures.</td>
</tr>
<tr>
<td>• Ready-to-eat food, such as deli meat, hot dogs, and soft cheeses</td>
<td><em>Newborns</em></td>
<td>• Prevent cross-contamination between raw or undercooked food and ready-to-eat food.</td>
</tr>
<tr>
<td></td>
<td><em>Sepsis</em></td>
<td>• Avoid using unpasteurized dairy products.</td>
</tr>
<tr>
<td></td>
<td><em>Pneumonia</em></td>
<td>• Control time and temperature.</td>
</tr>
<tr>
<td></td>
<td><em>Meningitis</em></td>
<td></td>
</tr>
</tbody>
</table>
Bacteria  Enterohemorrhagic and shiga toxin-producing *Escherichia coli* (ess-chur-EE-kee-UH KO-LI), including O157:H7, O26:H11, O111:H8, and O158:NM

Illness  Hemorrhagic colitis (hem-or-RA-jik ko-LI-tiss)

Enterohemorrhagic and shiga toxin-producing *E. coli* can be found in the intestines of cattle. It is also found in infected people. The bacteria can contaminate meat during slaughtering. Eating only a small amount of the bacteria can make a person sick. Once eaten, it produces toxins in the intestines, which causes the illness. The bacteria are often in a person's feces for weeks after symptoms have ended.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Bacteria</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground beef (raw and undercooked)</td>
<td>Diarrhea (eventually becomes bloody)</td>
<td>Cook food, especially ground beef, to minimum internal temperatures.</td>
</tr>
<tr>
<td>Contaminated produce</td>
<td>Abdominal cramps</td>
<td>Purchase produce from approved, reputable suppliers.</td>
</tr>
<tr>
<td></td>
<td>Kidney failure (in severe cases)</td>
<td>Prevent cross-contamination between raw meat and ready-to-eat food.</td>
</tr>
</tbody>
</table>

Bacteria  *Clostridium perfringens*

Illness  *Clostridium perfringens* gastroenteritis (klos-TRID-e-em per-FRING-jins GAS-tro-EN-ter-l-tiss)

*Clostridium perfringens* is found in dirt, where it forms spores that allow it to survive. It is also carried in the intestines of both animals and humans.

*Clostridium perfringens* does not grow at refrigeration temperatures. It does grow rapidly in food in the temperature danger zone. Commercially prepped food is not often involved in outbreaks. People who get sick usually do not have nausea, fever, or vomiting.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Bacteria</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>Diarrhea</td>
<td>Cool and reheat food correctly.</td>
</tr>
<tr>
<td>Poultry</td>
<td>Severe abdominal pain</td>
<td>Hold food at the correct temperatures.</td>
</tr>
<tr>
<td>Dishes made with meat and poultry, such as stews and gravies</td>
<td></td>
<td>Control time and temperature.</td>
</tr>
</tbody>
</table>
**Bacteria**  *Clostridium botulinum* (kloz-TRID-ee um BOT-chew-LINE-um)

**Illness**  Botulism (BOT-chew-liz-urn)

*Clostridium botulinum* forms spores that are often found in water and dirt. These spores can contaminate almost any food. The bacteria do not grow well in refrigerated or highly acidic food or in food with low moisture. However, *Clostridium botulinum* grows without oxygen and can produce a lethal toxin when food is time-temperature abused. Without medical treatment, death is likely.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Bacteria</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Incorrectly canned food</td>
<td>Initially</td>
<td>• Hold, cool, and reheat food correctly.</td>
</tr>
<tr>
<td>• Reduced-oxygen packaged (ROP) food</td>
<td>• Nausea and vomiting</td>
<td>• Inspect canned food for damage.</td>
</tr>
<tr>
<td>• Temperature-abused vegetables, such as baked potatoes</td>
<td>Later</td>
<td>• Control time and temperature.</td>
</tr>
<tr>
<td>• Untreated garlic-and-oil mixtures</td>
<td>• Weakness</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Double vision</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Difficulty in speaking and swallowing</td>
<td></td>
</tr>
</tbody>
</table>

**Bacteria**  *Campylobacter jejuni* (Camp-ee-lo-BAK-ter jay-JUNE-ee)

**Illness**  Campylobacteriosis (CAMP-ee-lo-BAK-ter-eo-O-sis)

Though *Campylobacter jejuni* is commonly associated with poultry, it has been known to contaminate water. Illness often occurs when poultry is incorrectly cooked and when raw poultry has been allowed to cross-contaminate other food and food-contact surfaces. Campylobacteriosis is best controlled through correct cooking and the prevention of cross-contamination.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Bacteria</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Poultry</td>
<td>• Diarrhea (may be watery or bloody)</td>
<td>• Cook food, particularly poultry, to required minimum internal temperatures.</td>
</tr>
<tr>
<td>• Water contaminated with the bacteria</td>
<td>• Abdominal cramps</td>
<td>• Prevent cross-contamination between raw poultry and ready-to-eat food.</td>
</tr>
<tr>
<td>• Meats</td>
<td>• Fever</td>
<td>• Control time and temperature.</td>
</tr>
<tr>
<td>• Stews/gravies</td>
<td>• Vomiting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Headaches</td>
<td></td>
</tr>
</tbody>
</table>
## Bacteria: Salmonella spp. (Sal-meh-NEL-uh)
### Illness: Salmonellosis (Sal-men-uh-LÖ-sis)
Many farm animals carry Salmonella spp. naturally. Eating only a small amount of these bacteria can make a person sick. How severe symptoms are depends on the health of the person and the amount of bacteria eaten. The bacteria are often in a person’s feces for weeks after symptoms have ended.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Bacteria</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poultry and eggs</td>
<td>Diarrhea</td>
<td>Cook poultry and eggs to minimum internal temperatures.</td>
</tr>
<tr>
<td>Dairy products</td>
<td>Abdominal cramps</td>
<td>Prevent cross-contamination between poultry and ready-to-eat food.</td>
</tr>
<tr>
<td>Produce</td>
<td>Vomiting</td>
<td>Keep food handlers who have been diagnosed with salmonellosis out of the operation.</td>
</tr>
<tr>
<td></td>
<td>Fever</td>
<td></td>
</tr>
</tbody>
</table>

## Bacteria: Salmonella Typhi (Sal-meh-NEL-uh Ti-fee)
### Illness: Typhoid fever
Salmonella Typhi lives only in humans. People with typhoid fever carry the bacteria in their bloodstream and intestinal tract. Eating only a small amount of these bacteria can make a person sick. The severity of symptoms depends on the health of the person and the amount of bacteria eaten. The bacteria are often in a person’s feces for weeks after symptoms have ended.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Bacteria</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready-to-eat food</td>
<td>High fever</td>
<td>Exclude food handlers who have been diagnosed with an illness caused by Salmonella Typhi from the operation.</td>
</tr>
<tr>
<td>Beverages</td>
<td>Weakness</td>
<td>Wash hands.</td>
</tr>
<tr>
<td></td>
<td>Abdominal pain</td>
<td>Cook food to minimum internal temperatures.</td>
</tr>
<tr>
<td></td>
<td>Headache</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loss of appetite</td>
<td>Prevent cross-contamination.</td>
</tr>
<tr>
<td></td>
<td>Rash</td>
<td></td>
</tr>
</tbody>
</table>
### Shigella spp. (shih-GEHL-uh)

**Illness**: Shigellosis (SHIG-uh-LO-sis)

Shigella spp. is found in the feces of humans with the illness. Most illnesses occur when people eat or drink contaminated food or water. Flies can also transfer the bacteria from feces to food. Eating only a small amount of these bacteria can make a person sick. High levels of the bacteria are often in a person’s feces for weeks after symptoms have ended.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Bacteria</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
</table>
| - Food that is easily contaminated by hands, such as salads containing TCS food (potato, tuna, shrimp, macaroni, and chicken) | - Bloody diarrhea  
- Abdominal pain and cramps  
- Fever (occasionally) | - Exclude food handlers who have been diagnosed with an illness caused by Shigella spp. from the operation.  
- Exclude food handlers who have diarrhea from the operation.  
- Wash hands.  
- Control flies inside and outside the operation.  
- Practice personal hygiene. |
| - Food that has made contact with contaminated water, such as produce | | |

### Staphylococcus aureus (STAF-uh-lo-KOK-us OR-ee-us)

**Illness**: Staphylococcal gastroenteritis (STAF-uh-lo-KOK-al GAS-tro-EN-ter-I-tiss)

*Staphylococcus aureus* can be found in humans—particularly in the hair, nose, and throat; and in infected cuts. It is often transferred to food when people carrying it touch these areas on their bodies and then handle food without washing their hands. If allowed to grow to large numbers in food, the bacteria can produce toxins that cause the illness when eaten. Cooking cannot destroy these toxins, so preventing bacterial growth is critical.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Bacteria</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
</table>
| Food that requires handling during prepping | - Nausea  
- Vomiting and retching  
- Abdominal cramps | - Wash hands, particularly after touching the hair, face, or body.  
- Cover wounds on hands and arms.  
- Hold, cool, and reheat food correctly.  
- Practice personal hygiene. |
| - Salads containing TCS food (egg, tuna, chicken, and macaroni)  
- Deli meat | | |

### Vibrio vulnificus and Vibrio parahaemolyticus (VIB-ree-o vul-NIF-ih-kus and VIB-ree-o PAIR-uh-HEE-mo-lit-ih-kus)

**Illnesses**: Vibrio gastroenteritis (VIB-ree-o GAS-tro-EN-ter-I-tiss)  
Vibrio vulnificus primary septicemia (VIB-ree-o vul-NIF-ih-kus SEP-ti-SEE-mee-uh)

These bacteria are found in the waters where shellfish are harvested. They can grow very rapidly at temperatures in the middle of the temperature danger zone. People with chronic conditions (such as diabetes or cirrhosis) who become sick from these bacteria may get primary septicemia. This severe illness can lead to death.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Bacteria</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
</table>
| - Oysters from contaminated water | - Diarrhea  
- Abdominal cramps and nausea  
- Vomiting  
- Low-grade fever and chills | - Cook oysters to minimum internal temperatures.  
- Purchase from approved, reputable suppliers. |
Viruses

<table>
<thead>
<tr>
<th>Virus</th>
<th>Hepatitis A (HEP-a-It-iiss)</th>
<th>Illness</th>
<th>Hepatitis A</th>
</tr>
</thead>
</table>

Hepatitis A is mainly found in the feces of people infected with it. The virus can contaminate water and many types of food. It is commonly linked with ready-to-eat food. However, it has also been linked with shellfish from contaminated water.

The virus is often transferred to food when infected food handlers touch food or equipment with fingers that have feces on them. Eating only a small amount of the virus can make a person sick. An infected person may not show symptoms for weeks but can be very infectious. Cooking does not destroy hepatitis A.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Virus</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready-to-eat food</td>
<td>• Fever (mild)</td>
<td>• Exclude staff who have been diagnosed with hepatitis A from the operation.</td>
</tr>
<tr>
<td>Shellfish from contaminated water</td>
<td>• General weakness</td>
<td>• Exclude staff who have jaundice from the operation.</td>
</tr>
<tr>
<td></td>
<td>• Nausea</td>
<td>• Wash hands.</td>
</tr>
<tr>
<td></td>
<td>• Abdominal pain</td>
<td>• Avoid bare-hand contact with ready-to-eat food.</td>
</tr>
<tr>
<td></td>
<td>• Jaundice (appears later)</td>
<td>• Purchase shellfish from approved, reputable suppliers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Virus</th>
<th>Norovirus (NOR-o-VI-ruh)</th>
<th>Illness</th>
<th>Norovirus gastroenteritis</th>
</tr>
</thead>
</table>

Like hepatitis A, Norovirus is commonly linked with ready-to-eat food. It has also been linked with contaminated water. Norovirus is often transferred to food when infected food handlers touch food or equipment with fingers that have feces on them.

Eating only a small amount of Norovirus can make a person sick. It is also very contagious. People become contagious within a few hours after eating it. The virus is often in a person’s feces for days after symptoms have ended.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Virus</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ready-to-eat food</td>
<td>• Vomiting</td>
<td>• Exclude staff who have been diagnosed with Norovirus from the operation.</td>
</tr>
<tr>
<td>Shellfish from contaminated water</td>
<td>• Diarrhea</td>
<td>• Exclude staff with diarrhea and vomiting from the operation.</td>
</tr>
<tr>
<td></td>
<td>• Nausea</td>
<td>• Wash hands.</td>
</tr>
<tr>
<td></td>
<td>• Abdominal cramps</td>
<td>• Avoid bare-hand contact with ready-to-eat food.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Purchase shellfish from approved, reputable suppliers.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Practice personal hygiene.</td>
</tr>
</tbody>
</table>
### Parasites

**Parasite**  *Anisakis simplex* *(ANN-ih-SAHK-iss SIM-plex)*  
**Illness**  *Anisakiasis* *(ANN-ih-SAHK-KYE-ah-sis)*  

People can get sick when they eat raw or undercooked fish containing this parasite.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Parasite</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw and undercooked fish</td>
<td>• Tingling in throat</td>
<td>• Cook fish to minimum internal temperatures.</td>
</tr>
<tr>
<td></td>
<td>• Coughing up worms</td>
<td>• If serving raw or undercooked fish, purchase sushi-grade fish that has been frozen to the correct time-temperature requirements.</td>
</tr>
<tr>
<td>• Herring</td>
<td></td>
<td>• Purchase from approved, reputable suppliers.</td>
</tr>
<tr>
<td>• Cod</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Halibut</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Mackerel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pacific salmon</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Parasite**  *Cryptosporidium parvum* *(KRIH-TOH-spor-ID-ee-um PAR-vum)*  
**Illness**  *Cryptosporidiosis* *(KRIH-TOH-spor-id-ee-O-sis)*  

*Cryptosporidium parvum* can be found in the feces of infected people. Food handlers can transfer it to food when they touch food with fingers that have feces on them. Day-care and medical communities have been frequent locations of person-to-person spread of this parasite. Symptoms will be more severe in people with weakened immune systems.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Parasite</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Contaminated water</td>
<td>• Watery diarrhea</td>
<td>• Use correctly treated water.</td>
</tr>
<tr>
<td>• Produce</td>
<td>• Abdominal cramps</td>
<td>• Keep food handlers with diarrhea out of the operation.</td>
</tr>
<tr>
<td></td>
<td>• Nausea</td>
<td>• Wash hands.</td>
</tr>
<tr>
<td></td>
<td>• Weight loss</td>
<td>• Purchase from approved, reputable suppliers.</td>
</tr>
</tbody>
</table>
**Parasite**  *Giardia duodenalis* (jē-ARE-dee-uh do-WAH-den-AL-is), also known as *G. lamblia* or *G. intestinalis*

**Illness**  *Giardiasis* (JEF-are-DYE-uh-sis)

*Giardia duodenalis* can be found in the feces of infected people. Food handlers can transfer the parasite to food when they touch food with fingers that have feces on them.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Parasite</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Incorrectly treated water</td>
<td>Initially</td>
<td>• Use correctly treated water.</td>
</tr>
<tr>
<td>• Produce</td>
<td>• Fever</td>
<td>• Keep food handlers with diarrhea out of the operation.</td>
</tr>
<tr>
<td></td>
<td>Later</td>
<td>• Wash hands.</td>
</tr>
<tr>
<td></td>
<td>• Diarrhea</td>
<td>• Purchase from approved, reputable suppliers.</td>
</tr>
<tr>
<td></td>
<td>• Abdominal cramps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Nausea</td>
<td></td>
</tr>
</tbody>
</table>

**Parasite**  *Cyclospora cayetanensis* (Sī-klo-spōr-uh KAY-uh-te-NEH-sis)

**Illness**  *Cyclosporiasis* (Sī-klo-spōr-i-uh-sis)

*Cyclospora cayetanensis* is a parasite that has been found in contaminated water and has been associated with produce irrigated or washed with contaminated water. It can also be found in the feces of infected people. Food handlers can transfer the parasite to food when they touch it with fingers containing feces. For this reason, food handlers with diarrhea must be excluded from the operation. It is also critical to purchase produce from approved, reputable suppliers.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Parasite</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Incorrectly treated water</td>
<td>• Nausea</td>
<td>• Purchase produce from approved, reputable suppliers.</td>
</tr>
<tr>
<td>• Produce such as berries, lettuce, or basil</td>
<td>• Abdominal cramps</td>
<td>• Keep food handlers with diarrhea out of the operation.</td>
</tr>
<tr>
<td></td>
<td>• Mild fever</td>
<td>• Wash hands.</td>
</tr>
<tr>
<td></td>
<td>• Diarrhea alternating with constipation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Loss of weight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Loss of appetite</td>
<td></td>
</tr>
</tbody>
</table>
### Toxins

<table>
<thead>
<tr>
<th>Toxin</th>
<th>Illness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histamine</td>
<td>Scombroid poisoning</td>
</tr>
</tbody>
</table>

Histamine poisoning can occur when high levels of histamine in scombroid and other species of fish are eaten. When the fish are time-temperature abused, bacteria on the fish make the toxin. It cannot be destroyed by freezing, cooking, smoking, or curing.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Toxin</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuna</td>
<td>Initially</td>
<td>• Prevent time-temperature abuse during storage and prepping.</td>
</tr>
<tr>
<td>Bonito</td>
<td>• Reddening of the face and neck</td>
<td>• Purchase from approved, reputable suppliers.</td>
</tr>
<tr>
<td>Mackerel</td>
<td>• Sweating</td>
<td></td>
</tr>
<tr>
<td>Mahimahi</td>
<td>• Headache</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Burning or tingling sensation in the mouth or throat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Possibly later</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Diarrhea</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Vomiting</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Toxin</th>
<th>Illness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciguatoxin</td>
<td>Ciguatera fish poisoning</td>
</tr>
</tbody>
</table>

Ciguatoxin is found in some marine algae. The toxin builds up in certain fish when they eat smaller fish that have eaten the toxic algae. Ciguatoxin cannot be detected by smell or taste. It is not eliminated by cooking or freezing the fish. Symptoms may last months or years depending on how severe the illness is.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Toxin</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Predatory tropical reef fish from the Pacific Ocean, the western part of the Indian Ocean, and the Caribbean Sea.</td>
<td>• Reversal of hot and cold sensations</td>
<td>• Purchase predatory tropical reef fish from approved, reputable suppliers.</td>
</tr>
<tr>
<td>Barracuda</td>
<td>• Nausea</td>
<td></td>
</tr>
<tr>
<td>Grouper</td>
<td>• Vomiting</td>
<td></td>
</tr>
<tr>
<td>Jacks</td>
<td>• Tingling in fingers, lips, or toes</td>
<td></td>
</tr>
<tr>
<td>Snapper</td>
<td>• Joint and muscle pain</td>
<td></td>
</tr>
</tbody>
</table>
### Toxin: Saxitoxin (SAX-ih-TOX-in)
**Illness:** Paralytic shellfish poisoning (PSP) (PAIR-ah-LIT-ik)

Some types of shellfish can become contaminated as they filter toxic algae from the water. People get sick with paralytic shellfish poisoning (PSP) when they eat these shellfish. Saxitoxin cannot be smelled or tasted. It is not destroyed by cooking or freezing. Death from paralysis may result if high levels of the toxin are eaten.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Toxin</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shellfish found in colder waters, such as those of the Pacific and New England coasts.</td>
<td>Numbness</td>
<td>Purchase shellfish from approved, reputable suppliers.</td>
</tr>
<tr>
<td>• Clams</td>
<td>Tingling of the mouth, face, arms, and legs</td>
<td></td>
</tr>
<tr>
<td>• Mussels</td>
<td>Dizziness</td>
<td></td>
</tr>
<tr>
<td>• Oysters</td>
<td>Nausea</td>
<td></td>
</tr>
<tr>
<td>• Scallops</td>
<td>Vomiting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diarrhea</td>
<td></td>
</tr>
</tbody>
</table>

### Toxin: Brevetoxin (BRFV-ih-TOX-in)
**Illness:** Neurotoxic shellfish poisoning (NSP) (NUR-o-TOX-iik)

Some types of shellfish can become contaminated as they filter toxic algae from the water. People get sick with neurotoxic shellfish poisoning (NSP) when they eat these shellfish. Brevetoxin cannot be smelled or tasted. It is not destroyed by cooking or freezing.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Toxin</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shellfish found in the warmer waters of the west coast of Florida, the Gulf of Mexico, and the Caribbean Sea.</td>
<td>Tingling and numbness of the lips, tongue, and throat</td>
<td>Purchase shellfish from approved, reputable suppliers.</td>
</tr>
<tr>
<td>• Clams</td>
<td>Dizziness</td>
<td></td>
</tr>
<tr>
<td>• Mussels</td>
<td>Reversal of hot and cold sensations</td>
<td></td>
</tr>
<tr>
<td>• Oysters</td>
<td>Vomiting</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diarrhea</td>
<td></td>
</tr>
</tbody>
</table>

### Toxin: Domoic acid (duh-MO-ik)
**Illness:** Amnesic shellfish poisoning (ASP) (am-NEE-zik)

Some types of shellfish can become contaminated as they filter toxic algae from the water. People get sick with amnesic shellfish poisoning (ASP) when they eat these shellfish. The severity of symptoms depends on the amount of toxin eaten and the health of the person. Domoic acid cannot be smelled or tasted. It is not destroyed by cooking or freezing.

<table>
<thead>
<tr>
<th>Food Commonly Linked with the Toxin</th>
<th>Most Common Symptoms</th>
<th>Prevention Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shellfish found in the coastal waters of the Pacific Northwest and the east coast of Canada.</td>
<td>Initially</td>
<td>Purchase shellfish from approved, reputable suppliers.</td>
</tr>
<tr>
<td>• Clams</td>
<td>Vomiting</td>
<td></td>
</tr>
<tr>
<td>• Mussels</td>
<td>Diarrhea</td>
<td></td>
</tr>
<tr>
<td>• Oysters</td>
<td>Abdominal pain</td>
<td></td>
</tr>
<tr>
<td>• Scallops</td>
<td>Possibly later</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Confusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Memory loss</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Disorientation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Seizure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Coma</td>
<td></td>
</tr>
</tbody>
</table>
A
active managerial control, 8.3
corrective action, 8.3
definition of, 8.3
monitoring, 8.3
verification, 8.3
ways to achieve, 8.3
additives, 6.2, 6.6, 8.10
air gap, 9.6
allergy, food
common food allergens, 2.17
cross-contact and, 2.18
preventing allergic reactions, 2.18
symptoms of, 2.17
antiseptics, 3.6 (see hand antiseptics)
apron, 3.11

B
backflow, 9.5, 9.6
air gap, 9.6
definition of, 9.5
double check valve backflow preventers, 9.6
prevention, 9.6
reduced pressure zone backflow preventers, 9.6
vacuum breaker, 9.6
backsiphonage, 9.5
bacteria, 2.3
characteristics of, 2.3
conditions for growth, 2.4
enterohemorrhagic and shiga toxin-producing E. coli, 2.5
preventing bacteria, 2.5
Salmonella spp., 2.5, 4.3
Salmonella Typhi, 2.5
Shigella spp., 2.5
sources of bacteria, 2.5
Staphylococcus aureus, 3.2
baked potatoes, 1.6
bare-hand contact, 2.6, 2.7, 3.4, 3.10, 7.5
beans, 1.6
beef cooking requirements, 6.10
bimetallic stemmed thermometer, 4.6
features of, 4.6
sensing area of, 4.6
temperature range, 4.6
biological contamination, 2.3
  bacteria, 2.3
  biological toxins, 2.8
  parasites, 2.7
  sources of, 2.3
  symptoms of, 2.3
  viruses, 2.6
bulk food, 7.9 (see labeling)

C
  canned food, 5.5
    receiving, 5.5
  Centers for Disease Control and Prevention (CDC), 1.8
  chemical contamination, 2.9
    prevention of, 2.9
    sources of, 2.9
    symptoms of, 2.9
  chemicals, 2.9
    storage of, 2.9
  chewing gum, 3.12
  children's menu, 6.12
  chlorine, 10.2 (see also sanitizing: guidelines for)
    cleaners, 10.2
  cleaning, 1.5, 4.3, 10.2
    after people who get sick, 10.12
    cleaners, 10.2
    dishwashing machine, 10.7
    garbage containers, 9.7
    master cleaning schedule, 10.12, 10.15
    three-compartment sink, 10.9
  cleaning and sanitizing, 1.5
    how to clean equipment, 10.5
    how to clean surfaces, 10.4
  cold holding, 7.2, 7.3
  common food-handling mistakes (see risk factors)
  consumer advisory, 6.12, 8.4
  contaminants (see contamination)
  contaminated water, 2.5
contamination, 1.4, 2.2, 3.2
  actions that can contaminate food, 3.3
  biological, 1.4, 2.3
  chemical, 1.4, 2.9
  definition of, 1.4
  deliberate contamination, 2.13
  physical, 1.4, 2.10
  cooking, 6.9
    microwave, 6.11
    partial cooking, 6.11
    specific food requirements, 6.9
    cooking temperatures, 6.9
  cooling, 6.15
    factors, 6.16
    methods, 6.16
    temperature requirements for, 6.15
  corrective action, 4.4, 8.7
  critical control points (CCPs), 8.6
  critical limits, 8.6
  cross-connection, 9.5
  cross-contact, 2.18
    preventing, 2.19
  cross-contamination, 1.5, 4.3
    equipment, 4.3
    prevention during storage, 5.10
    ways to prevent, 4.3
  crustaceans, 1.6
  curing food, 6.6, 8.10
  custom-processing animals, 6.6, 8.10
D
date marking, 5.9
deliveries, 5.2
  key drop deliveries, 5.3
dishwashing machine, 9.3, 10.7
  chemical-sanitizing machine, 10.7
  cleaning, 9.3
  guidelines, 10.8
  high-temperature machine, 10.7
  installation, 9.3
dishwashing, manual, 10.8
double check valve backflow preventers, 9.6
E
egg mixtures (see eggs)
eggs, 1.6, 2.17, 5.5, 6.4
  cooking, 6.10
  high-risk populations and, 6.5
  pasteurized, 6.4
  pooled eggs, 6.4
  receiving, 5.5
emergencies, 9.10
enterohemorrhagic and shiga toxin-producing *Escherichia coli* (see bacteria)

**equipment**

- 4.3, 9.2
- installing, 9.2
- maintaining, 9.2
- selecting, 9.2

**exclusion or restriction**, 3.13

**F**

facilities

- garbage, 9.7
- interior requirements, 9.2
- lighting, 9.6
- maintenance, 9.8
- plumbing, 9.5
- utilities, 9.5
- ventilation, 9.7

**FAT TOM**, 2.4

**FDA Model Food Code**, 1.9

**FIFO**, 5.10, 9.11

first-in, first-out (see FIFO)

finger-nails, 3.7 (see hand care)

**fish**, 1.6, 2.17

- cooking, 6.10
- documentation for, 5.6
- ground fish, 5.11
- receiving, 5.4
- storage, 5.12

**flow of food**, 4.2

**food additives**, 6.2 (see additives)

**food allergen** (see also allergy, food)

- definition of, 2.17

**Food and Drug Administration (FDA)**, 1.8

**foodborne illness**, 1.2

- cost of, 1.3
- definition of, 1.2
- outbreak, 1.2
- responding to, 2.15
- symptoms of, 2.3

food defense program, 2.13

**food handlers**, 3.2

- attire, 3.10
- cleanliness, 3.10
- contaminating food, 3.2
- drinking, 3.12
- eating, 3.12
- exclusion or restriction, 3.13

**food safety**

- challenges to, 1.2
- measures, 1.8

food safety management system, 8.2

- foundation of, 8.2

**frozen food**, 5.5

- receiving, 5.5
- storage temperature, 5.9

fungi, 2.7

**G**

**garbage**, 9.7, 9.11

- cleaning of containers, 9.7
- containers, 9.7
- pests, 9.7
- removal, 9.7

**gloves**, 3.8 (see also glove use)

- guidelines for, 3.8

**glove use**, 3.4

- how to use gloves, 3.9
- when to change, 3.9

**Good Agricultural Practices (GAP)**, 5.2

**Good Manufacturing Practices (GMP)**, 5.2

**ground beef**, 2.5

- ground fish, 5.12, 6.10
- cooking, 6.10

**ground meat**, 2.5, 6.10

**hand washing**, 2.5

**H**

**hair restraints**, 3.11

**hand antiseptics**, 3.6

**hand care**, 3.4, 3.7

- false fingernails, 3.7
- fingernail length, 3.7
- infected wounds, 3.7
- nail polish, 3.7

**handwashing**, 3.4

- handwashing station, 9.4
- how to wash hands, 3.5
- when to wash hands, 3.6
- where to wash hands, 3.5

**handwashing station**, 9.4

- automatic, 9.4

**requirements**, 9.4
hazard analysis, 8.5
Hazard Analysis Critical Control Point (HACCP), 8.4
  corrective action, 8.7
  critical control points (CCPs), 8.6
  critical limits, 8.6
  definition of, 8.4
  example, 8.6, 8.9
  monitoring procedures, 8.7
  principles of, 8.4
  record keeping, 8.8
  specialized processing methods, 8.10
  verification of, 8.8
hepatitis A (see viruses)
high-risk populations, 1.7 6.5, 6.12
holding, 7.2
  cold food, 7.2
  guidelines for, 7.2
  hot food, 7.2
  without temperature control, 7.3
holding food without temperature control, 7.3
  cold food, 7.3
  hot food, 7.4
hot holding, 7.2, 7.4
hot-holding equipment, 7.2

I
ice, 6.5
  as an ingredient, 6.5, 7.8
ice scoops, 6.5
infrared (laser) thermometer, 4.8
inspecting, 5.2
inspection report of suppliers, 5.2
iodine, 10.2 (see also sanitizing: guidelines for)

J
jewelry, 3.11

K
key drop deliveries, 5.3

L
labeling food, 2.19
  bulk food, 7.9
  for off-site service, 7.9
  for retail sale, 5.8
  for use on-site, 5.8
  held without temperature control, 7.3, 7.4
  in self-service areas, 7.8
TCS food, 5.9
  with allergens, 2.19
leafy greens, 1.6 (see also produce)
leftover food, 6.5
lighting, 9.6

M
machines, 10.7
master cleaning schedule, 10.15
  monitoring, 10.15
  training, 10.15
Material Safety Data Sheet (MSDS), 2.9, 10.14
maximum registering thermometer, 4.8
meat, 1.6
  cooking, 6.10
  receiving, 5.4
  storage, 5.11
melons, 1.6
menu, 6.12 (see consumer advisory)
microorganism, 2.3
microwave cooking, 6.11
milk, 1.6, 2.17, 5.5
  receiving, 5.5
  monitoring time and temperature, 4.6

N
Norovirus, 2.7, 3.6 (see viruses)
NSF, 9.2

O
Occupational Safety and Health Administration (OSHA), 10.14
off-site service, 7.9
  delivery vehicles, 7.9
  food containers, 7.9
  labeling food for, 7.9
  storage, 7.9
  utilities, 7.9

P
parasites, 2.7
  characteristics of, 2.7
  prevention of, 2.7
  sources of parasites, 2.7
pathogen, 1.4, 2.3, 2.8
  definition of, 2.3
  types of, 2.3
peanuts, 2.17
personal cleanliness, 3.10
personal hygiene, 1.5, 3.4
personal hygiene program, 3.4
  handwashing, 3.4
  manager’s role in, 3.4
post control operator (PCO), 9.11
pests, 9.11
  access, 9.11
  feces, 9.12
  nests, 9.12
  shelter, 9.11
pH, 2.4, 10.3
physical contamination, 2.10
  prevention of, 2.10
  sources of, 2.10
  symptoms of, 2.10
plumbing, 9.5
pooled eggs, 6.4
pork
  cooking, 6.10
  storage, 5.11
poultry, 1.6
  cooking, 6.10
  receiving, 5.4
  storage, 5.11
preparation, 6.2
  corrective actions during, 6.3
  guidelines for, 6.2
  guidelines for produce, 6.4
prepared food, 4.3
preset tableware, 7.7
preventing allergic reactions, 2.18
  service staff role in, 2.18
preventing bacteria (see bacteria)
preventing biological toxins (see toxins, biological)
preventing cross-contamination, 4.9, 5.10
  (see also cross-contamination)
preventing viruses (see viruses)
produce, 2.5
  preparation guidelines, 6.4
  public health intervention, 8.4
purchasing, 5.2
  guidelines for, 5.2
Q
quaternary ammonium compounds, or quats, 10.2
  (see also sanitizing; guidelines for)
R
raw food, 7.8
  in self-service area, 7.8
ready-to-eat food, 1.6, 2.5, 2.6, 2.7, 7.8
  in self-service area, 7.8
reheating, 6.17
storage order, 5.11
storage time for, 5.9
recall by manufacturer, 5.4
  guidelines for, 5.4
receiving, 5.3
  documents, 5.6
  food quality, 5.6
  packaging, 5.5
  rejecting received items, 5.3, 5.5, 5.6
  temperature, 5.4
reconditioning, 6.3
record keeping, 8.8
reduced-oxygen packaged (ROP) food, 5.4, 6.6, 8.10
  rejecting received items, 5.5
  variance needed for, 6.6
reduced pressure zone backflow preventers, 9.6
reheating, 6.17
  for hot-holding, 6.17
  for immediate service, 6.17
reporting health issues, 3.12
re-serving food, 7.7
  bread or rolls, 7.7
  condiments, 7.7
  garnishes, 7.7
  menu items, 7.7
  prepackaged food, 7.7
rice, 1.6
risk factors, 1.4, 8.3
  controlling, 8.4
rotation of food in storage, 5.10
salads, 2.5
  containing TCS food, 6.5
Salmonella spp., 2.5, 4.3 (see bacteria)
Salmonella Typhi, 2.5
sanitizers, 10.2
sanitizing, 1.5, 4.3, 10.2
  after people who get sick, 10.12
  chemical sanitizing, 10.2
  dishwashing machine, 10.7
  effectiveness, 10.3
  guidelines for, 10.3
  heat sanitizing, 10.2
  master cleaning schedule, 10.12, 10.15
  three-compartment sink, 10.9
self-service areas, 7.8
  bulk food, 7.9
  guidelines for, 7.8
  raw food, 7.8
  refills, 7.8
serving, 7.5
  guidelines for kitchen staff, 7.5
  guidelines for service staff, 7.6
  high-risk populations, 6.12
  preset tableware, 7.7
  re-serving food, 7.7
shellfish, 1.6, 2.8, 2.17, 5.5, 5.6, 6.6
  live shellfish, 6.6
  receiving, 5.5
  shellstock identification tags, 5.6
  storage, 5.11
shellstock identification tags, 5.6
  definition of, 5.6
Shigella spp. (see bacteria)
smoking, 3.12
smoking food, 6.6, 8.10
sneeze guards, 7.2, 7.8
sources of bacteria (see bacteria)
sources of parasites (see parasites)
sources of viruses (see viruses)
soy, 1.6, 2.17
sprouting seeds, 8.10
sprouts, 1.6, 6.4, 6.6
staff illnesses, 3.13
state and local regulatory authorities, 1.9
  responsibilities, 1.9
storage
  chemicals, 10.14
  utensils, 10.10
storage order, 5.11
storage temperature, 5.9
storing, 5.8
  chemicals, 10.13
  cleaning tools, 10.13
  equipment, 10.10
  flatware, 10.10
  glasses, 10.10
  guidelines for, 5.9
  location, 5.11
  tableware, 10.10
  waste and recyclables, 9.7
storing food
  for further cooling, 6.16
  suppliers, 5.2

tableware
  preset, 7.7
  storing, 10.10
TCS food, 1.6, 2.5
  holding, 7.2
  in vending machines, 7.10
  minimum cooking temperatures, 6.9
  reheating, 6.17
  storage temperature, 5.9
  storage time, 5.9
thawing, 6.3
  temperature, checking, 4.9
  temperature danger zone, 4.4
thawing, 6.3
thermistors, 4.7
  air probes, 4.7
  immersion probes, 4.7
  penetration probes, 4.7
  sensing area, 4.7
  surface probes, 4.7
thermocouples, 4.7
  air probes, 4.7
  immersion probes, 4.7
penetration probes, 4.7
sensing area, 4.7
surface probes, 4.7
thermometers, 4.6
accuracy of, 4.9
bimetallic stemmed thermometer, 4.6
calibration of, 4.9
glass, 4.9
guidelines for care and use, 4.9
infrared (laser), 4.8
thermistors, 4.7
thermocouples, 4.7
time-temperature indicator (TTI), 4.8
threats, 9.10
three-compartment sink, 9.3, 10.8
set up, 10.8
steps to clean and sanitize, 10.9
time-temperature abuse, 1.5, 4.4
avoiding, 4.4
definition of, 1.5
time-temperature control, 4.4
time-temperature indicator (TTI), 4.8
tobacco, 3.12
tofu, 1.6
tomatoes, 1.6
toxins, biological, 2.8
illnesses from, 2.8
preventing biological toxins, 2.8
sources of, 2.8
training, 1.8
tree nuts, 2.17

U
U.S. Department of Agriculture (USDA), 1.8, 1.9
U.S. Public Health Service (PHS), 1.8
utensils, 7.5
cleaning, 7.5
sanitizing, 7.5
storing, 7.5

V
vacuum breaker, 9.6
variance, 6.6, 8.10
definition of, 6.6, 8.10
when needed, 6.6
vending machine, 7.10
guidelines for, 7.10
product shelf life, 7.10
ventilation, 9.7
viruses, 2.6
characteristics, 2.6
destruction of, 2.6
hepatitis A, 2.6, 6.5
Norovirus, 2.7
preventing viruses, 2.6, 2.7
sources of viruses, 2.6, 2.7

W
water, 9.5
backflow, 9.5
backsiphonage, 9.5
cross-connection, 9.5
water activity (a_w), 2.4
wheat, 2.17
work attire, 3.10
aprons, 3.11
guidelines for, 3.11
hair restraints, 3.11
jewelry, 3.11
wounds, 3.2, 3.3, 3.4, 3.7, 3.10
infected wounds, 3.7