LESSON 8
Chill Out: The Importance of Cold Temperatures in Food Safety

GOAL

To understand the importance of cold temperatures in the handling and storage of food.

OBJECTIVES

- To recognize that foodborne pathogens do not grow but can survive at freezer temperatures. Also, to understand that pathogens grow very slowly, or not at all, at refrigerator temperatures.
- To describe acceptable methods for thawing.
- To identify the safe temperature for cold holding.
- To describe the proper method of cooling foods for storage.

TEACHER BACKGROUND INFORMATION

Lesson 8 covers

1. The importance of cold temperatures
2. Thawing time/temperature control for safety foods
3. Holding time/temperature control for safety foods at cold temperatures (cold holding)
4. Cooling requirements for time/temperature control for safety foods
5. Air circulation

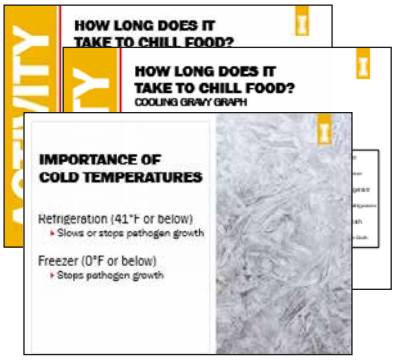
Approximate time to teach lesson: 25–40 min

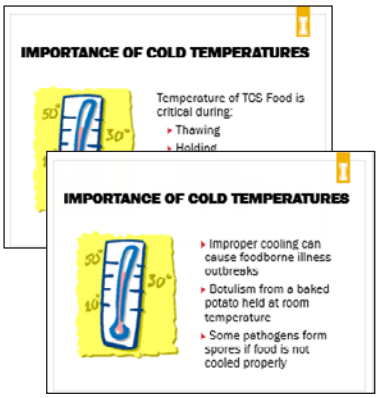
Definition

potable water—Water that is safe to drink or to use in food-service preparation.

MATERIALS NEEDED

- Graph paper for students to plot gravy-cooling data
- Several sets of six different-colored pens or pencils
- Copies of the Gravy Temperature Data Table provided at the end of the lesson





(Slide 1) **Lesson 8**

Chill Out: The Importance of Cold Temperatures in Food Safety

(Slide 2) **How Long Does It Take to Chill Food?**

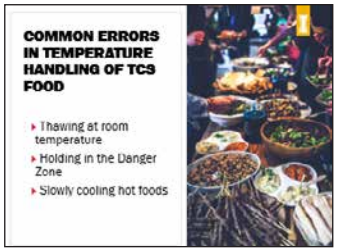
It is often difficult to realize the amount of time required to cool hot foods. As shown in a handout, an experiment was conducted where the testers cooled 1 qt of hot gravy under various conditions while recording the temperatures as it cooled. Have students graph the data from the handout to illustrate the hot gravy's rate of cooling at room temperature, in the refrigerator, and in an ice bath in both deep and shallow containers. Put the time (6 hrs in 15- or 30-min increments) on the x-axis and the temperatures (40°F to 200°F in 10° or 20° increments) on the y-axis.

- (Slide 3) shows the gravy-cooling data for graphing.
- (Slide 4) shows the graph that contains the gravy-cooling data.

1. (Slide 5) **The Importance of Cold Temperatures**
   a. **Cold Temperatures Limit Pathogen Growth**. Pathogen growth is stopped or severely limited when food is held at cold temperatures. As learned in Lesson 2, bacteria like warm temperatures.
      - Bacteria do not grow at freezer temperatures. However, they do survive freezing temperatures and begin to grow when the temperature increases.
      - Some pathogens cannot grow at refrigerator temperatures; others (like *Listeria monocytogenes*) grow very slowly.

      - (Slide 6) Controlling temperature to keep time/temperature control for safety foods cold is critical during thawing, holding, preparing, cooling, and transporting foods.

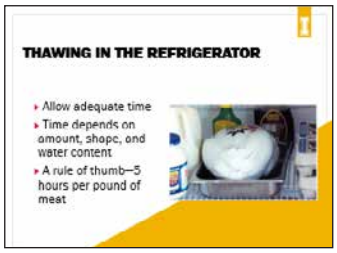
   b. (Slide 7) **Consequences of Improper Cooling**. Improper cooling has been implicated in a number of foodborne-illness outbreaks. It is thus particularly important to be careful in food service when cooling large quantities of food. Cooling large quantities takes care and planning.
      - Recall the audiotape of Linda's experience with botulism food poisoning from Lesson 1. Her illness was caused by a baked potato that was cooled improperly (held at room temperature for too long).
      - By cooking food, you destroy most or all vegetative pathogen cells. But three foodborne pathogens that form spores can survive (*Bacillus cereus*, *Clostridium botulinum*, and *Clostridium perfringens*). In fact, if you leave cooked food in the Danger Zone, these bacteria have a better chance to grow because competing microorganisms have been killed.
      - When thawing frozen food, make sure that you don't leave thawed outer surfaces in the Danger Zone while the center finishes thawing.



c. (Slide 8) **Common Errors in Temperature Handling of Food**. These errors in the temperature handling of food are most commonly seen in food service:
   - Thawing frozen food at room temperature
   - Holding in the Danger Zone
   - Slowly cooling hot foods

2. (Slide 9) **Thawing Time/Temperature Control for Safety Foods (TCS Foods)**. Foods thawed at room temperature may have surface temperatures that allow for bacteria to multiply even when the center is frozen solid. Many pathogenic bacteria can survive freezing and begin to grow again when the temperature of the food reaches the Danger Zone (41°F–135°F).

   The *Idaho Food Code* (3-501.13) governs the way time/temperature control for safety foods can be thawed: in the refrigerator, under running water, or during cooking. Thawing foods at room temperature is not acceptable.



   - (Slide 10) **In the Refrigerator (not to exceed 41°F)**. Allow adequate time for food to thaw. The time required depends on the amount of food to be thawed, its water content, and the shape of the package. Round, compact shapes take longer than flat, elongated shapes (ground beef vs. ribs). Foods with high water content require more time than foods with low water content (ground beef vs. sandwiches).
     - A three-pound package of frozen meat requires 24 hrs or more to thaw; an 8–12-lb turkey requires two days.
     - A rule of thumb is to allow five hours of thawing time per pound of meat.

   - (Slide 11) **Under Potable (Safe-To-Drink) Running Water at 70°F or Cooler**. It takes less time to thaw food using this method. Example: Place the frozen product in a large container, cover it with running water, and set it in the sink. A three-pound package of meat will thaw in 3–4 hrs.

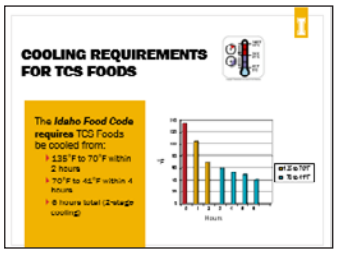
   - (Slide 12) **During the Cooking Process**. Thawing is also allowed while cooking a large roast or turkey that is still frozen or partially frozen. Example: grilling small cuts of frozen meat (steaks, chops, ground meat patties); thawing in the microwave, then cooking immediately afterward.

3. (Slide 13) **Holding Time/Temperature Control for Safety Foods at Hot and Cold Temperatures (Hot and Cold Holding).** The *Idaho Food Code* (3-501.16) requires that TCS food be held at temperatures above 135°F (hot holding) or below 41°F (cold holding).

   - (Slide 14) **Time in the Danger Zone** (*Idaho Food Code* 3-501.19). If TCS foods are held between 41°F and 135°F (the Danger Zone) for more than four hours, they must be discarded. Some food-

service establishments may choose not to cool TCS food during service, instead using time as the safety control. For example, at an outdoor barbeque, a caterer labels the food with the time it was placed at room temperature and discards it after four hours.

- **Date Marking** (*Idaho Food Code* 3-501.17). If TCS food is held refrigerated (41°F or below) for more than 24 hrs, it must be date marked. Date marked means that it is marked with the date by which it must be eaten, sold, or discarded. The food must be used within seven days.



4. (Slide 15) **Cooling Requirements for Time/Temperature Control for Safety Foods**. The *Idaho Food Code* (3-501.14) regulates the quickness with which TCS food must be cooled. The main consideration is whether or not the food will cool fast enough so that pathogens will not be able to multiply enough to cause a food-safety problem.

   a. **Requirements**. TCS hot foods must be cooled from 135°F to 70°F within 2 hrs, and from 70° to 41°F within 4 more hrs, a total of 6 hrs (two-stage cooling). TCS food prepared at room temperature must be cooled to 41°F within 4 hrs.

   b. (Slide 16) **Techniques for Safe Cooling**

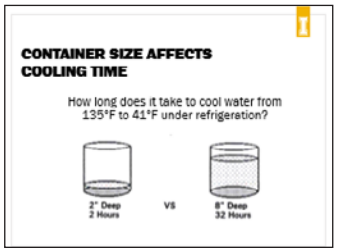
      - **Ice Bath**—Use an ice bath for foods such as sauces, soups, stew, etc. Surround the cooking container with ice and water and stir the food often until it is cool. If a large quantity needs to be cooled, divide it into smaller containers. Check the temperature of the cooled food with a thermometer. It needs to be 41°F or below and must reach this temperature within 6 hrs from the start of cooling. (2 hrs to 70°F and 4 more hrs to 41°F.)

      - **Ice Wand**—An ice wand (the Rapi-Kool paddle is one brand) is available from food-equipment suppliers. Fill the wand with water and freeze it; then place the wand in the center of the cooked food. Agitate and move it through the food often. As the food cools, the ice melts inside the wand. Wash and sanitize the paddle before each use.

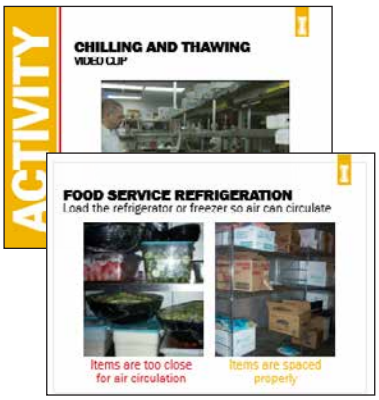
      - **Cold-Water Bath**—If ice is not available, place a small container of food in very cold water, then stir the food often to cool it. When the water warms, replace it with more cold water. Repeat until the food reaches 41°F on a thermometer.

      - **Shallow Pans**—Large, bulky foods such as large cuts of meat are slow to cool. For example, an 8-lb roast in a walk-in cooler requires 5 hrs to cool to 70°F from the serving temperature of 135°F; it will take an additional 12 hrs to cool below 41°F. This rate of cooling is too slow to meet the requirements.

Slice the meat and spread it in shallow pans at a depth of no more than 2 in. Remove stuffing from stuffed meats and refrigerate them in separate containers. Pans can be cooled quickly by setting them in a container of ice and immediately putting them in the refrigerator when cool. A metal container transfers the heat out of the product faster than plastic.



- (Slide 17) **Container Size Affects Cooling Time**—This graphic was taken from the *Idaho Food Safety and Sanitation Manual*. Cooling occurs slowly when foods are stored in large, deep containers in refrigerators: 8 in of water requires 32 hrs to cool to 41°F, 2 in requires only 2 hrs. The outer portion cools when in contact with cool air, but the center of the container remains warm for hours—a perfect environment for dangerous bacteria to grow.



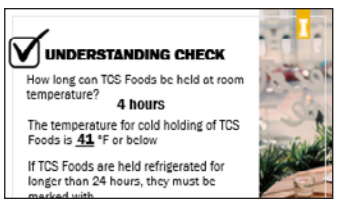
(Slide 18) **"Chilling and Thawing Review"**
Show video clip (1:58) by clicking on the picture on Slide 18. The video clip shows chilling and thawing in a restaurant setting.

5. (Slide 19) **Air Circulation**
   - There needs to be room for cold air to circulate in the refrigerator and freezer.
   - An overpacked refrigerator or freezer slows down the cooling process, because cold air cannot circulate. Be sure to leave space around items.
   - If overloaded with hot foods, the refrigerator temperature can rise and allow foods to stay in the Danger Zone.
   - Cover foods loosely to allow air circulation while still protecting them from contamination.
   - Keep refrigerator and freezer doors shut to maintain cold temperatures.

(Slide 20) UNDERSTANDING CHECK

(Slide 21) **Question**: What happens to pathogen growth at refrigerator and freezer temperatures?
Answer: It slows or stops.

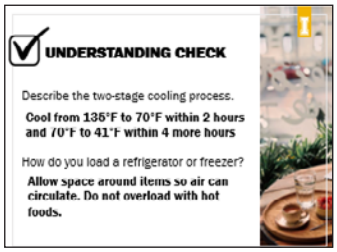
Question: Name three methods to properly thaw foods.
Answer: Thaw food products in the refrigerator, under cold running water, or as part of the cooking process.



(Slide 22) **Question**: How long can TCS food be held at room temperature?
Answer: Do not hold TCS food at room temperatures for more than 4 hrs.

Question: The temperature for cold holding of TCS food is ___°F or below.
Answer: 41°F

Question: If TCS food is held refrigerated for longer than 24 hrs, it must be marked with what?
Answer: The date the TCS must be used by (within seven days).



(Slide 23) **Question**: Describe the two-stage cooling process.
Answer: Cooling requirements are from 135°F to 70°F in 2 hrs and 70°F to 41°F in 4 more hrs. To accomplish this, divide leftovers into small portions in small containers. Remove stuffing from stuffed meats and refrigerate them in separate containers. Use an ice water bath or Rapi-Kool paddle to cool the food rapidly and frequently stir the food.

Question: How do you load a refrigerator or freezer to promote proper cooling?
Answer: Load refrigerator or freezer so air can circulate. Do not overload refrigerators with hot foods.

(Slides 24–26) **Who Left the Food Out? (2:17)**
The song is about the general consequence of improper cooling—getting sick.

WHO LEFT THE FOOD OUT? ("Who Let the Dogs Out" by Baha Men)

Who left the food out?
Who left the food out?
Who left the food out?
Who left the food out?

On the day of the party the kitchen was jumpin'
(Yippie-I-O)
Lots of good food all over the place
(Yippie-I-O)
Problem was we couldn't keep it all chillin'
(Yippie-I-O)
After a while, the fridge had no space
So we used the counter

Who left the food out?
Who left the food out?
Who left the food out?
Who left the food out?

A friend came up to me and said we've got a safety problem
What should we do, I don't know
I guess we'll go ahead and take a chance
The guests arrived and they started eatin'

(Yippie-I-O)
They'd eat a lot and then eat some more
(Yippie-I-O)
But after a while they stomachs be hurtin'
(Yippie-I-O)
And the line to the bathroom went out the front door
And the guests were screaming

Who left the food out?
Who left the food out?
Who left the food out?
Who left the food out?

A party host shouldn't make his guests sick
(When in doubt just throw it out, when in doubt just throw it out)
A party host shouldn't make his guests sick
(When in doubt just throw it out, when in doubt just throw it out)

Who left the food out?
Who left the food out?
Who left the food out?
Who left the food out?

Don't leave the food out
Don't leave the food out
Don't leave the food out
Don't leave the food out

REFERENCES

- Hemminger, J.M. *Food Safety: A Guide to What You Really Need to Know*. Ames: Iowa State University Press, 2000.
- Idaho Central District Health Department . "Part 2. Foodborne Illnesses: Holding Time and Temperature." Video clip. Boise: Idaho Central District Health Department, n.d. http://www.cdhd.idaho.gov/eh-food-training.
- *Idaho Food Code*. http://healthandwelfare.idaho.gov/Health/FoodProtection/IdahoFoodCode/tabid/765/Default.aspx.
- *Idaho Food Safety and Sanitation Manual*
- McSwane, D., N. Rue, and R. Linton. *Essentials of Food Safety and Sanitation*. Upper Saddle River, NJ: Prentice Hall, 1998.

LESSON 8
How Long Does It Take to Chill Food?

Divide students into groups of two and provide each group with graph paper, pens or pencils of six different colors, and a copy of the Gravy Temperature Data Table on the next page. Ask the students to record the time data points (6 hrs in 15- or 30-minute increments) on the x-axis and temperature data points (40°F to 200°F in 10° or 20° increments) on the y-axis.

Gravy at 197°F

Refrigerator

Room Temperature

Ice Bath

LESSON 8
Gravy Temperature Data Table

Directions. Graph the data in the table below to illustrate the rate of cooling of hot gravy when it is cooled at room temperature, in the refrigerator, and in an ice bath. Put time (6 hrs in 15- or 30-min increments) on the x-axis and temperature (40°F to 200°F in 10° or 20° increments) on the y-axis.

Temperatures (°F) Recorded For Cooling 4 Cups Of Hot Gravy Using Various Conditions

	Cooled at Room Temperature (70°F)		Cooled in the Refrigerator (40°F)		Cooled in an Ice Bath (33°F)	
Time when temperature was taken*	**Deep container**	**Shallow container**	**Deep container**	**Shallow container**	**Deep container**	**Shallow container**
Start (0 min)	197°	197°	197°	197°	197°	197°
15 min	168°	148°	169°	130°	140°	114°
30 min	150°	131°	144°	124°	115°	87°
45 min	137°	116°	131°	110°	97°	73°
1 hr	124°	104°	117°	97°	83°	62°
1:15	115°	96°	106°	89°	74°	57°
1:30	105°	89°	97°	81°	69°	52°
1:45	101°	83°	91°	74°	64°	51°
2:00	96°	82°	87°	72°	62°	49°
2:15	90°	78°	82°	67°	59°	47°
2:30	85°	75°	74°	62°	57°	44°
2:45	80°	**69°	67°	55°	51°	41°
3:00	78°		65°	53°	45°	
3:30	75°		62°	51°	41°	
4:00	72°		59°	48°		
4:30	**70°		58°	44°		
5:00			56°	42°		
5:30			53°	41°		
6:00			51°			

*Temperature recorded every 15 min for first 3 hrs, then recorded every 30 min to 6 hrs, the maximum time permitted to reach 41°F.

**Stopped recording temperature, as gravy would not cool further at room temperature.

READY, SET, FOODSAFE