Thermometers—Tools of the Trade

1. Describe how temperature relates to bacterial growth in food.
2. Identify the appropriate thermometer to use for each step in the food flow process and for specific food products.
3. List advantages and disadvantages for various types of thermometers.

Materials
- VCR and monitor
- Videotape, Your Guide to Thermometers in Foodservice
- Thermometer Toolkit
- Copies of Handout 1 for each participant (page 18)
- Flip chart
- Marking pens
- Food Safety Mini-Posters
- 3 x 5 in. index cards or 8 1/2 x 11 in. paper
- Large copies of International Food Safety Icons (which can be downloaded from the accompanying CD-ROM)

Note to Trainer
All employees may not need all lesson components. The trainer can select sections most appropriate for individuals being trained.

Lesson Format
Lesson 1 can be taught as one lesson or as multiple short lessons. If all material and activities in the lesson are covered, the lesson will take 1 hour to complete. This approach would be appropriate for an in-service training day.

If time is limited, the lesson could be broken down into smaller units. Possible divisions for shorter lessons:

- Temperature and Bacterial Growth, Key Point 1 ................. 10 minutes
- Temperature and Bacterial Growth, Key Point 2 ................. 10 minutes
- Tools of the Trade, Key Point 1 ......................................... 10 minutes
- Tools of the Trade, Key Point 2 ......................................... 30 minutes
Temperature and Bacterial Growth

**Key Point 1**
Maintaining appropriate temperatures is very important in foodservice operations.

*Estimated time: 10 minutes*

Maintaining appropriate temperatures will:
- Ensure that food is safe for children to eat.
- Minimize bacterial growth. Bacteria multiply quickly in food when in the temperature danger zone, which may make food unsafe to eat.
- Maintain the quality of food.

**Review** the Temperature Danger Zone, 41 °F to 135 °F. Follow State/local regulations.

**Stress** the fact that bacteria grow very rapidly in the temperature danger zone and that is why it is recommended that foods be kept out of the temperature danger zone.

The International Association for Food Protection developed a set of “signs” or international food safety icons to communicate important food safety messages. These signs can be used in foodservice operations, on recipes, and in other places as reminders about critical food safety practices. There are more food safety icons, but these are the ones that focus on temperature and temperature control.

**Activity Idea**
Give each participant a copy of Handout 1, *Name the Icon*. Ask participants to identify the key message that each food safety icon is trying to convey. Discuss each key message and its importance in foodservice. Answer key on page 19.
**Key Point 2**  
Temperatures must be monitored at specific steps when handling food and cooking potentially hazardous foods.

*Estimated time: 10 minutes*

**ACTIVITY IDEA**

Ask participants to brainstorm:
1. Steps that require temperature control
2. Foods that require temperature control

Make a list of participants’ ideas on a flip chart and post.

**Steps** that participants may identify include: receiving, storing, preparing/cooking, holding, transporting, serving, cooling, and reheating.

**Foods** listed by participants could include any potentially hazardous food, such as milk and milk products, shell eggs, meats, poultry, fish, melons, tofu, and heated plant foods such as cooked rice, beans, and potatoes.

**ACTIVITY IDEA**

Review the NFSMI Food Safety Mini-Posters (print copy from CD-ROM or order laminated copy from www.nfsmi.org or 800-321-3054). Five posters relate to topics discussed in this lesson:

1. Receiving Area
2. Storeroom Basics
3. Refrigerate for Safety!
4. Keep Hot Foods Hot! Keep Cold Foods Cold!
5. On the Serving Line

Place posters in appropriate places in the facility to reinforce ideas discussed in this lesson.

**Remind** participants that at each step, food must be kept at the appropriate temperature to minimize bacterial growth and to keep food safe to eat.
**Review** temperatures required for various steps and foods.

| **Receiving food** |  
|--------------------|-------------------------------------------------------------|
| Frozen foods       | at or below 32 °F (frozen solid, showing no signs of thawing, such as softness or wetness) |
| Fresh meat, poultry, or fish | 33 °F to 41 °F |
| Milk               | 33 °F to 41 °F |
| Fresh fruits and vegetables, refrigerated | 33 °F to 41 °F |

| **Storing food** |  
|------------------|-------------------------------------------------------------|
| Freezer storage  | at or below 0 °F |
| Refrigerated storage | 35 °F to 41 °F |
| Dry storage      | 50 °F to 70 °F |

| **Preparing/Cooking food** |  
|-----------------------------|-------------------------------------------------------------|
| Heat ready-to-eat foods     | 135 °F for 15 seconds |
| Ground Beef                 | 155 °F for 15 seconds |
| Poultry                     | 165 °F for 15 seconds |

| **Holding food** |  
|------------------|-------------------------------------------------------------|
| Cold foods       | at or below 41 °F |
| Hot foods        | at 135 °F or above |

| **Transporting food** |  
|-----------------------|-------------------------------------------------------------|
| Cold foods            | at or below 41 °F |
| Hot foods             | at 135 °F or above |

| **Serving food** |  
|------------------|-------------------------------------------------------------|
| Cold foods       | at or below 41 °F |
| Hot foods        | at 135 °F or above |

| **Cooling food** |  
|------------------|-------------------------------------------------------------|
| Two-stage process: cool from 135 °F to 70 °F in two hours (if not, take corrective action immediately) and from 70 °F to 41 °F in an additional 4 hours |

| **Reheating food** |  
|-------------------|-------------------------------------------------------------|
| Reheat leftovers  | 165 °F for 15 seconds |

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**ACTIVITY IDEA**

Write each bullet item (from list above) on a 3 x 5 in. card. Have each participant select one card. Review each step (receiving, storing, etc.) and ask the participant who has the card to state the appropriate temperature. **Or** Write each item on a sheet of paper. Hold up the sheet and ask participants to state the appropriate temperature.
Different types of thermometers are used in foodservice to monitor temperatures. Tools for taking temperatures are specific for the task, for example an oven thermometer is only used to take the internal temperature of the oven because it has the capability of taking temperatures in the range of 200 °F to 600 °F.

**ACTIVITY IDEA**

Ask the following questions:
- What are some types of thermometers used in your facility?
- What are some differences among the various thermometers that are used in your facility?

Write down ideas from participants on a flip chart.

**Characteristics of Thermometers**

Characteristics of thermometers that make them unique for a function:

1. Temperature range—for example:
   - a. Oven thermometers—from 150 °F to 600 °F
   - b. Meat thermometers—from 130 °F to 190 °F
   - c. Hot holding thermometers—from 100 °F to 175 °F
   - d. Freezer thermometers—from -40 °F to 80 °F
   - e. Storeroom thermometers—from -60 °F to 120 °F

2. Placement—for example:
   - a. Wall mounted such as in a storeroom
   - b. Mounted on the outside of a freezer, refrigerator, or milk cooler
   - c. Hanging on a rack such as in an oven or in the refrigerator
   - d. Inserted into food products to take internal temperatures

3. Reading—for example:
   - a. Digital
   - b. Dial
   - c. Color change (for one-time use sensors)
Thermometer Types and Uses

**Key Point 2**
The appropriate thermometer should be selected for the temperature being taken.

*Estimated Time: 30 minutes*

<table>
<thead>
<tr>
<th>Type/Characteristics of Thermometer</th>
<th>Advantages/Disadvantages</th>
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<tbody>
<tr>
<td><strong>Storage/Appliance Thermometers</strong></td>
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</table>
| Refrigerator/Cooler—Provides internal temperature of refrigerators and milk coolers  
  • Range of -40 °F to 80 °F | **Advantages**  
  • Monitors temperatures for food quality  
  • Monitors temperatures for food safety  
  **Disadvantages**  
  • Placement in refrigerator/cooler may affect temperature (for example, temperature may be different near the door than in the back of unit)  
  • Internal thermometers that sit or hang on shelves are easily broken and lost |
| Freezer—Provides internal temperature of freezers  
  • Range of -40 °F to 80 °F | **Advantages**  
  • Monitors temperatures to keep food frozen  
  • Monitors temperatures for food quality  
  **Disadvantages**  
  • Placement in freezer may affect temperature (for example, temperature may be different near the door than in the back of unit)  
  • Internal thermometers that sit or hang on shelves are easily broken and lost |

Appropriate thermometers should be selected based on their function and use. Thermometers should be accurate within ± 2 °F. **Note:** All thermometers presented are ones that can be purchased separately (not built into equipment) for use in foodservice.

**Activity Idea**
Using the Thermometer Toolkit you assembled, show each thermometer or picture of thermometer as you talk about it. Pass thermometers around for participants to examine and handle (if available).

**Activity Idea**
Show the first segment of the videotape, Your Guide to Thermometers in Foodservice.
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| Storeroom—Provides temperatures of storeroom, may be mounted on the wall or placed on shelves | **Advantages**  
- Monitors temperature for food quality  
- Monitors temperature to reduce spoilage  
**Disadvantages**  
- Placement in storeroom may affect temperature (for example, temperature may be different by door than in back of storeroom) |
|  | ```
| Food Thermometers | |
| **Bimetallic Stemmed**—Used to check the internal temperatures of food | **Advantages**  
- Inexpensive  
- Readily available  
- Easy to calibrate  
**Disadvantages**  
- Sensing region of stem about 2 in.  
- Temperatures averaged over the sensing region  
- Not effective for thin foods, such as hamburger patties  
- Loses calibration with physical shock such as dropping  
- Limited temperature range  
- Dial may be difficult to read accurately |
|  | ```
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| **Bimetallic Stemmed, oven safe meat**—Used in meats, such as roasts, cooked in the oven | **Advantages**  
- Monitors safe end-point cooking temperature so recommendations are met  
- Monitors temperatures for quality of product  
**Disadvantages**  
- Heat conduction of metal stem can cause false high readings  
- Not effective for thin meats, such as hamburger patties  
- Loses calibration with physical shock such as dropping |
|  | ```
|  | ```
|  | ```
|  | ```
| **Digital Stemmed (Thermistor)**—Used to check the internal temperatures of food | **Advantages**  
- Gives fast readings  
- Easy to read  
- Tip sensitive—can measure temperature of thick and thin foods  
**Disadvantages**  
- Not all models can be calibrated |
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| **Thermocouple**—Used with probes of various types:  
  - Immersion—measures temperature of liquids  
  - Penetration—measures internal temperatures of food  
  - Surface—measures surface temperatures, such as griddle tops | **Advantages**  
  - Digital temperature reading  
  - Temperature sensed at the tip of the probe  
  - Wide variety of probes are available for use over a wide range of temperatures/products  
  - Provides rapid readings  
  - Durable  
  **Disadvantages**  
  - May be expensive to calibrate  
  - Accuracy may vary due to signal or change in voltage  
  - Accuracy seems to vary proportional to cost |
| **Infrared**—Designed to take surface temperatures from up to four feet away. Provides a quick check of temperatures of food at receiving, storing, and holding.  
  - Remove barriers between thermometer and item for which temperature is being taken. For example, do not take temperatures through glass or any other shiny surface. | **Advantages**  
  - Fast  
  - Accurate  
  - Nondestructive, noncontact measurement of temperature  
  - No contact eliminates cross-contamination  
  **Disadvantages**  
  - Can not measure internal temperatures  
  - Environmental conditions, such as relative humidity affect accuracy  
  - Accuracy affected by surface emissivity (ability of a surface to emit heat by radiation; varies by metal type, and surface color and polish) and shiny surfaces  
  - May be expensive to calibrate |
| **Cooking/Equipment Thermometers** |                          |
| **Oven**—Designed to check the internal temperatures of an oven.  
  - Range of 150 °F to 600 °F | **Advantages**  
  - Checks temperature for optimal quality of cooked product  
  **Disadvantages**  
  - Placement may affect temperature reading as temperature is not consistent throughout the oven  
  - Thermometers that hang on racks may be easily dropped |
Single Use Temperature Indicators

**T-Sticks® or Adhesive thermometers**—May be used for foods and to test the water temperature for high-temperature dish machines.
- Designed for single use
- Designed for specific endpoint temperatures

**Advantages**
- Checks temperature to make sure that food is held outside the temperature danger zone
- Accurate
- Easy to use
- Fast
- Time saving—does not require calibration, sanitizing
- Available for a variety of temperatures
- Reads temperatures within 5 seconds
- Eliminates possibility for cross contamination
- Temperature indicator can be saved on the temperature documentation form as evidence that temperatures were checked

**Disadvantages**
- Expensive because of one time use
- Several different ones are needed, depending on use. For example, T-Sticks® are available for 140 °F, 160 °F, 165 °F, and 170 °F.

**Note:** Candy thermometers generally are not used in school foodservice. They are designed to be accurate within ± 5 °F and are not accurate enough to measure temperatures of other foods.

**Data Loggers** can be used to monitor time and temperature. Data loggers can be programmed to read temperatures from every minute to every 4 hours, depending on use. A data logger could be placed in a refrigerator, cooler, or holding cabinet to record temperature over time. A data logger may be used to monitor temperature when transporting food. Information on data loggers can be downloaded to a computer, which allows time and temperatures to be monitored and documented.

**ACTIVITY IDEA**

Give each participant a thermometer (or a picture of a thermometer). Have them give a short “infomercial” to promote advantages, disadvantages, and typical uses of the thermometer.
HANDOUT 1

Name the Icon

Directions: Look at each food safety icon and identify the important food safety temperature message that is being conveyed.

1. 

2. 

3. 

4. 

5. 

6. 

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<table>
<thead>
<tr>
<th>Activity: Name the Icon Answers</th>
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<tbody>
<tr>
<td>1. Hot Holding</td>
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<tr>
<td>2. Potentially Hazardous Food (there is a time and temperature concern)</td>
</tr>
<tr>
<td>3. Cooking, thoroughly cook to appropriate temperatures</td>
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<tr>
<td>5. Refrigeration/Cold Holding</td>
</tr>
<tr>
<td>6. Temperature Danger Zone</td>
</tr>
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