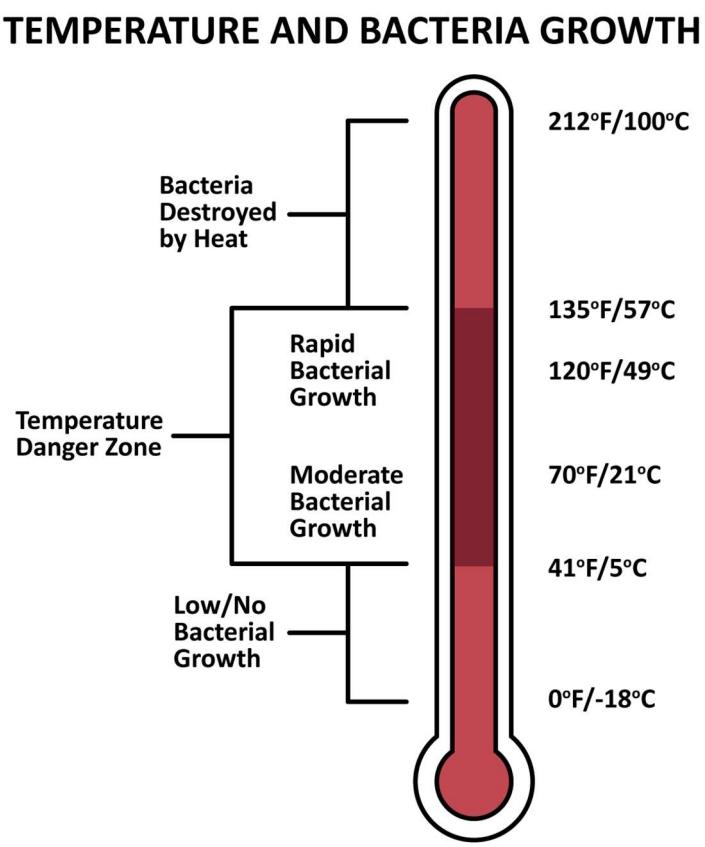
Chapter 5 – Limitation of Growth of Bacteria

EFFECTS OF TEMPERATURE ON BACTERIA

Because of the unique survival capability of bacteria, it is important to limit their growth in food. Bacterial growth is exponential, meaning that bacteria can double every few minutes. Their growth potential is shown in the following table:

Commercial canning temperatures (can only be obtained under pressure)	250°F 240°F	Food products essentially sterile, C. botulinum spores destroyed, S. aureus toxin not inactivated at these temperatures.
Water boils	212°F	Spores of C. botulinum and C. perfringens can survive for hours, Toxin of C. botulinum inactivated.
	165°F	Most bacteria dies; some spore-forming bacteria survive.
	140°F	No bacteria growth; some survive.
DANGER ZONE	135°F	
Hottest temperature hands can endure	125°F	Some bacterial growth; many survive.
Body temperature	98.6°F	Greatest bacterial growth and toxin production by some.
Room temperature	70°F	Rapid bacterial growth and toxin production by some.
Keep food safe: 135°F or above OR 41°F or below	46°F	
	41°F	Some bacterial growth.
Water freezes	32°F	No bacterial growth; many survive
	0°F	Slow death for many bacteria; some survive.

The following diagram can also be helpful to visualize the effect of **temperature.**



Limiting bacterial growth is achieved through a time-temperature control process. This process is critical during thawing, holding, preparation, cooling, and during the transportation of foods. Time-temperature control is a combination of both time and temperature to control for bacterial growth.

Foods maintained at unsafe temperatures for more than four (4) hours MUST be discarded. This time frame is **cumulative and includes** the time receiving, storing, preparation, cooking, cooling, holding, and reheating food.

THAWING

TCS foods must be thawed as fast as possible to limit bacterial growth during the process. **Thawing at ambient room temperature is not acceptable.**

The following methods of thawing TCS foods are acceptable:

- Under refrigeration.
- Under running water 70°F or less with sufficient water flow.
- As part of a continuous cooking process.

HOLDING

TCS foods must be held outside of the optimal growth temperature zone (**DANGER ZONE**) for bacteria, which is between 41°F and 135°F. Remember:

- **HOT HOLDING – 135˚F OR ABOVE**
- **COLD HOLDING – 41˚F OR BELOW**

TCS foods held in the danger zone for **MORE THAN 4 HOURS** are considered adulterated and may cause a foodborne outbreak if consumed. Adulterated foods MUST be discarded.

Frozen food must be held in the frozen state to prevent thawing.

PREPARATION

TCS ingredients for foods that will be consumed without further cooking (salads, sandwiches, filled pastry products, etc.) and reconstituted and fortified foods must be pre-chilled to **41˚F OR BELOW** prior to preparation. Failure to do so may contribute to increased bacterial growth.

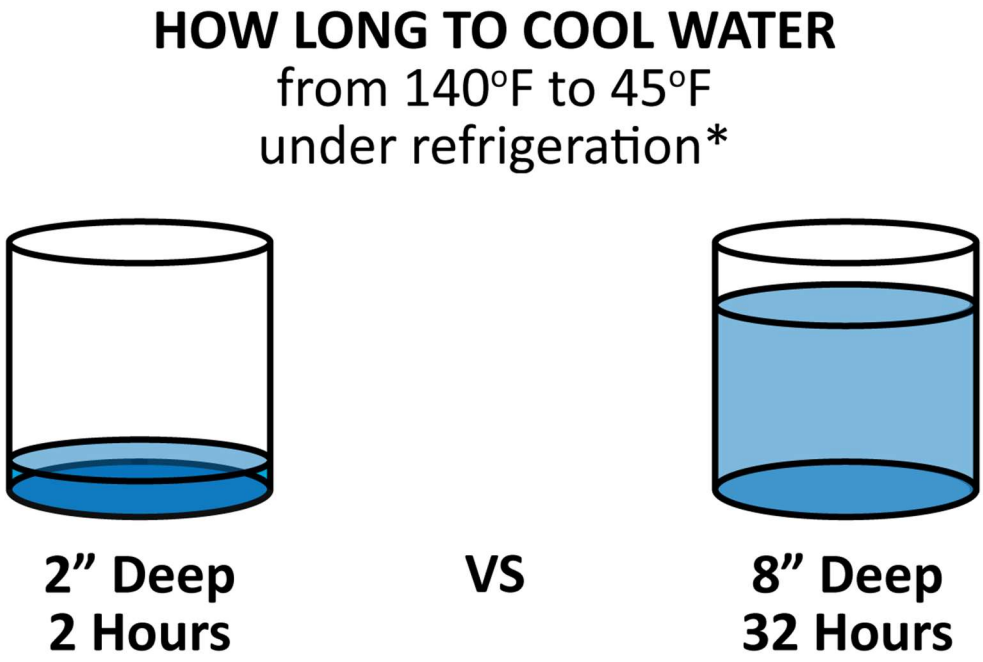
COOLING

Cooling food properly is very important as improper cooling is one of the most frequent causes of foodborne disease outbreaks. The main consideration is cooling food fast enough to reduce bacterial growth.

TCS food must be cooled **135°F to 70°F or less within two (2) hours and 70°F or less to 41°F or less within four (4) hours, for a total of six (6) hours.** The following cooling procedures may be used:

- Stirring food in a container placed in an ice water bath.
- Use ice wands to help stir hot foods and get them to cool quickly.
- Using rapid chilling equipment. **Home-style equipment is not suitable for this purpose**.
- Arrange containers in refrigeration equipment for maximum heat transfer. Do not stack cooling containers or put them close together.
- Loosely cover during the cooling period to allow air circulation in the container.
- Some foods, such as large roasts, will need to be cut into smaller portions (generally 4 inches thick) to allow for proper cooling.
- Place food in shallow pans or containers (maximum depth of 2 inches) to reduce the volume and/or increase the surface area, and breaking the food down into smaller or thinner portions.

The following example of water cooling gives importance to this requirement:



* Actual test results using Hazard Analysis and Critical Control Points (HACCP)

TRANSPORTATION

The same temperature considerations mentioned above also apply when TCS foods are being transported.

FACILITIES

To ensure proper food temperatures, sufficient equipment for temperature control (both in number of units and capacity) must be provided.

CHECK TEMPERATURES OFTEN

Food temperatures cannot be accurately determined by touching the container with the hand. Just a few degrees in the "danger zone" are enough to allow some disease bacteria to grow. Use a metal or plastic stem thermometer to check food temperatures. **Use it often**.

Know how to properly use the thermometer. Review Section 4 of this manual, if necessary.

SUMMARY

Limit bacterial growth in TCS foods by adherence to the following ***time-temperature control processes***:

- Thaw TCS foods under refrigeration, running water or during the cooking process.
- Keep TCS foods 135°F or above or 41°F or below.
- Cool TCS foods rapidly.
- Use pre-chilled ingredients for TCS foods not requiring cooking.

Check temperatures often with an approved thermometer.

Reference: ***Idaho Food Code,*** Section 3-5.