



# UNIT-6

## Principle 3: Establish the Critical Limits

### Learning Outcomes

By the end of this unit the learner will be able to:

- Understand the concept of critical limits in the context of controlling food safety
- Discuss the importance of ensuring all critical limits are scientifically based
- Provide common examples of critical limits and how they are monitored/controlled

## Unit 06

### Principle 3: Establish the Critical Limits

A critical limit is a maximum and/or minimum value to which a biological, chemical or physical parameter must be controlled at a CCP to prevent, eliminate or reduce to an acceptable level the occurrence of a food safety hazard. A critical limit is used to distinguish between safe and unsafe operating conditions at a CCP. Critical limits should not be confused with operational limits which are established for reasons other than food safety.

Each CCP will have one or more control measures to assure that the identified hazards are prevented, eliminated or reduced to acceptable levels. Each control measure has one or more associated critical limits. Critical limits may be based upon factors such as: temperature, time, physical dimensions, humidity, moisture level, water activity ( $a_w$ ), pH, titratable acidity, salt concentration, available chlorine, viscosity, preservatives, or sensory information such as aroma and visual appearance.

Critical limits must be scientifically based. For each CCP, there is at least one criterion for food safety that is to be met. An example of a criterion is a specific lethality of a cooking process such as a 5D reduction in *Salmonella*. The critical limits and criteria for food safety may be derived from sources such as regulatory standards and guidelines, literature surveys, experimental results, and experts.

An example is the cooking of beef patties ([Appendix B](#)). The process should be designed to ensure the production of a safe product.

## APPENDIX B

### Example of a Flow Diagram for the Production of Frozen Cooked Beef Patties



The hazard analysis for cooked meat patties identified enteric pathogens (e.g., verotoxigenic *E. coli* such as *E. coli* O157:H7, and salmonellae) as significant biological hazards. Furthermore, cooking is the step in the process at which control can be applied to reduce the enteric pathogens to an acceptable level.

To ensure that an acceptable level is consistently achieved, accurate information is needed on the probable number of the pathogens in the raw patties, their heat resistance, the factors that influence the heating of the patties, and the area of the patty which heats the slowest. Collectively, this information forms the scientific basis for the critical limits that are established. Some of the factors that may affect the thermal destruction of enteric pathogens are listed in the following

table. In this example, the HACCP team concluded that a thermal process equivalent to 155° F for 16 seconds would be necessary to assure the safety of this product.

To ensure that this time and temperature are attained, the HACCP team for one facility determined that it would be necessary to establish critical limits for the oven temperature and humidity, belt speed (time in oven), patty thickness and composition (e.g., all beef, beef and other ingredients).

Control of these factors enables the facility to produce a wide variety of cooked patties, all of which will be processed to a minimum internal temperature of 155° F for 16 seconds. In another facility, the HACCP team may conclude that the best approach is to use the internal patty temperature of 155° F and hold for 16 seconds as critical limits. In this second facility the internal temperature and hold time of the patties are monitored at a frequency to ensure that the critical limits are constantly met as they exit the oven. The example given below applies to the first facility.

Process Step	CCP	Critical Limits
5. Cooking	YES	Oven temperature: ___ ° F Time; rate of heating and cooling (belt speed in ft/min): ___ ft/min Patty thickness: ___ in. Patty composition: e.g. all beef Oven humidity: ___ % RH

**Further Reading:**

- ✓ *The Affirming Way of Life: See the Good, Speak the Good, Spread the Good Kindle Edition by Gail Siggelakis ,2019*
- ✓ *The Gift of Global Talent: How Migration Shapes Business, Economy & Society 1st Edition by William R. Kerr,2018*