

# Hot Holding Temperatures

## NATIONAL ADVISORY COMMITTEE ON MICROBIOLOGICAL CRITERIA FOR FOODS

January 25, 2002

The Committee was asked to provide a recommendation to FDA regarding the hot holding temperature specified in the Food Code. (A copy of the [subcommittee membership list](#) is attached.) The subcommittee met on November 13, 2001, in Washington, DC, and discussed the questions posed by FDA to NACMCF. Representatives from FDA and the food industry presented additional background on the hot holding issue. In advance of the meeting, FDA provided a background document that contained pertinent issues for NACMCF to consider, including information about the following: Target organisms; human epidemiology; highest temperature of concern for outgrowth of spores; role of evaporative cooling; critical limit for the hot holding temperature; impact on public health due to a lowering of the recommended hot holding temperature; and FDA's current thinking on hot holding. (A [copy of the background document](#) is attached.)

FDA asked NACMCF to consider the following questions:

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1. Should the hot holding temperature in the Food Code be changed from 140 degrees Fahrenheit to a lower temperature, and if so, should there be associated monitoring and record keeping requirements?
2. Is there an increased risk to food safety if the temperature is lowered from 140 degrees Fahrenheit?
3. If a "margin of safety" needs to be associated with a lower temperature, what should it be?
4. What minimum time/temperature parameters for hot holding would ensure food safety?
5. Should there be monitoring and/or record keeping requirements associated with hot holding at temperatures less than 140 degrees Fahrenheit?

**Question 1:** Should the hot holding temperature in the Food Code be changed from 140 degrees Fahrenheit to a lower temperature, and if so, should there be associated monitoring and record keeping requirements?

**Response:** The Committee concluded that the temperature can be lowered from 140 degrees Fahrenheit and result in safe product if dwell time is associated with any temperature lower than 140 degrees Fahrenheit. The Committee prefaced this conclusion by adding that monitoring, record keeping, and documentation are components of the basic principles of Hazard Analysis and Critical Control Point (HACCP). HACCP is the optimal framework for building science-based process control to prevent food safety hazards into food production systems.

**Question 2:** Is there an increased risk to food safety if the temperature is lowered from 140 degrees Fahrenheit?

**Response:** The Committee noted, based on the information provided by FDA, that just over one-quarter of the surveyed food service and retail establishments currently are not in compliance with the 140 degree Fahrenheit recommendation. The 140 degree Fahrenheit recommendation provided a substantial safety margin. In addition, the Committee concluded that many of the reported foodborne outbreaks are associated with gross temperature abuse at temperatures probably well below 140 degrees Fahrenheit and, possibly, for long periods of time. Neither sporadic foodborne outbreaks nor temperature and dwell time associated with hot holding are adequately captured by surveillance. Consequently, the Committee concluded that there is increased risk to food safety, due to a smaller safety margin, if the temperature is lowered from 140 degrees Fahrenheit for periods of time sufficient to allow multiplication of vegetative cells from spore-forming microorganisms.

**Question 3:** If a "margin of safety" needs to be associated with a lower temperature, what should it be?

**Response:** The Committee noted that the margin of safety should be greater than the capability of the hot holding equipment to maintain safe hot holding temperatures (i.e., if the equipment is capable of maintaining a +/- 5 degree temperature range from the target temperature, the minimum product temperature should be greater than the upper temperature of the equipment temperature range). In addition, safe hot holding temperatures should be above the growth range for *Clostridium perfringens* and *Bacillus cereus*. Although the maximum growth temperature would be near 125 degrees Fahrenheit, variation in the food matrix, uniformity of the temperature within the product, and equipment capability play a significant role in ensuring that the temperature is above the growth range. Food service and retail establishments do monitor product temperatures and times to confirm that they are meeting food safety critical limits. However, it may not be feasible for some food service and retail establishments to maintain written documentation of their monitoring results. The Committee also reviewed the information on evaporative cooling and concluded that there is insufficient data to adequately address the impact on product temperature. Because of the data gap, the Committee concluded that a 5 degree temperature safety margin above the growth range for *Clostridium perfringens* might be necessary and that hot holding of product below the safety margin (i.e., below 130 degrees Fahrenheit) might be considered unsafe, for purposes of food service and retail establishments.

**Question 4:** What minimum time/temperature parameters for hot holding would ensure food safety?

**Response:** A product temperature of 130 degrees Fahrenheit will control growth of foodborne pathogens during hot holding, with a margin of safety. However, FDA surveys<sup>[1]</sup> have shown food temperatures to be highly variable. When 130 degrees Fahrenheit is used as a minimum hot holding temperature, it is essential that data exist to demonstrate that 130 degrees Fahrenheit is the minimum temperature in the coldest part of the food at all times to account for such things as evaporative cooling, equipment capability, and food matrix dynamics. When data do not exist to verify that 130 degrees Fahrenheit is the minimum temperature in the coldest part of the food at all times, the margin of safety should be increased through the use of both time and temperature control. For non-continuous temperature and time monitoring, a minimum hot holding temperature of 130 degrees Fahrenheit for a maximum time of 4 hours, based on information provided by FDA regarding the limitation of growth of *Clostridium perfringens* to no more than 1 log<sub>10</sub> in food<sup>[2]</sup>, would be adequate to ensure food safety. In addition, the Committee concluded that a minimum temperature of 135 degrees for a maximum of 8 hours, or a minimum temperature of 140 degrees Fahrenheit indefinitely also would be adequate to ensure food safety. Finally, the Committee concluded that any food that requires temperature and time control for safety that is maintained during hot holding at a lower temperature or for a longer time than recommended by the Committee is unsafe for purposes of food service and retail establishment use.

**Question 5:** Should there be monitoring and/or record keeping requirements associated with hot holding at temperatures less than 140 degrees Fahrenheit?

**Response:** As previously suggested, food service and retail establishments conduct monitoring activities to confirm that they are within food safety critical limits. However, record keeping practices have not been widely adopted, especially amongst the very small operations. The Committee concluded that monitoring, record keeping, and documentation are essential components of HACCP and should be better used by the food service and retail establishments for hot holding, regardless of the temperature or time combination.

#### **Other Recommendations to FDA:**

1. FDA should consider developing additional educational materials for food service and retail operations regarding hot holding, including the importance of the seven principles of HACCP, accurate temperature measurement, identification of equipment capability. The Committee felt that a 30- to 60-day record keeping recommendation should be included in the Food Code as part of hot holding documentation.
2. FDA should assess the impact of any change to the Food Code hot holding recommendation and the use of time in lieu of temperature. From the Committee discussion, there appears to be a potential for conflict between these two provisions.
3. FDA should consider gathering additional information when conducting surveys related to hot holding at food service and retail operations. In particular, information about the food matrix, the amount of time product was held below the minimum recommended temperature, the procedures used by food service and retail operations to maintain adequate temperature throughout the product (e.g., stirring, rotating, covering, adding hot product, etc.).

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[1] FDA, "Hot Holding," NACMCF, September 2001, Table 8, Figure 1, and Table 10.

[2] FDA, "Hot Holding," NACMCF, September 2001, Table 12.

#### **Attachments**

#### **Members of the Subcommittee**

- Stephanie Doores
- Frances Downes
- Daniel Engeljohn (Chair)
- Mahipal Kunduru
- John Kvenberg
- Angela Ruple
- Robert (Skip) Seward
- William Sperber

