
Critical Limit Summary for Smoking Bacon

During 2003-2007 we have studied the issue of growth of pathogenic bacteria during slow-cooking of meats. In a published paper, and the Ph.D. dissertation from which that paper is derived, we can offer one set of Critical Limits that could be applied to smoking of bacon. USDA Guidance provides a second set of Critical Limits. A brief summary of the two sets of Critical Limits is provided below.

Background The pathogens of concern on raw pork bellies would *Salmonella* and *Staphylococcus aureus*. If the smoking step, which can be considered partial-cooking, is done very slowly and at a temperature allowing bacterial growth, it is possible that both of these pathogens could grow. Bacon is generally cooked to a very high temperature before it is eaten by the consumer, so even if *Salmonella* grew during slow-cooking it is unlikely that cells would survive on the cooked product. However, *S. aureus* will produce heat-stable enterotoxin when it grows. Cooking will not destroy the enterotoxin. Therefore we must ensure that the smoking conditions prevent *S. aureus* growth. *S. aureus* will grow and produce enterotoxin at temperatures up to 115°F.

In Appendix A, USDA states that heating processes in which the product temperature is between 50 and 130°F for more than 6 hours are viewed as “especially hazardous”.

Therefore, **Critical Limit Set 1** is “Product temperature is not between 50 and 130°F for more than 6 hours during smoking.”

We also did targeted research to investigate the slow-cooking of bacon.

Research Study: Commercial pumped pork bellies were obtained and inoculated on the interior and exterior with *Salmonella* and *S. aureus*. The inoculated bellies were subjected to a range of simulated industry slow partial-cooking procedures. Periodically, the process was briefly interrupted and pork belly samples were collected and analyzed for numbers of *S. aureus* cells present.

Research Results No growth of *Salmonella* or *S. aureus* was detected in any of the pork bellies during any of the slow partial-cooking procedures. Therefore, we can use the time/temperature history from the least severe process tested to establish our Critical Limits.

Validated Critical Limits:

Critical Limit Set #2 is “Product internal temperature will increase from 70°F to 86°F in no more than 50 minutes, from 86°F to 104°F in no more than 60 minutes, and from 104 to 115°F in no more than 50 minutes. Product internal temperature will be maintained at 115°F or higher until cooling begins.

Evaluating Microbial Safety of Slow Partial-Cooking Processes for Bacon: use of a Predictive Tool Based on Small-Scale Isothermal Meat Inoculation Studies. 2006. J. Food Protection 69:602-608.

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The University of Wisconsin-Madison Center for Meat Process Validation provides science-based HACCP support to small meat processors in meeting state and federal mandates for safe food processing and handling. For more information on the Center contact Dr. Steve Ingham, 1605 Linden Drive, UW-Madison, Madison, WI 53706 (608) 265-4801 Email: scingham@wisc.edu

