

## CENTER FOR MEAT PROCESS VALIDATION

### Slow-Cooking of Ham

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**Category:** Ready-to-eat meats

**USDA HACCP Category:** Fully cooked, not shelf stable

**Processing:** Cooking

**CCP:** Cooking

**Validates:** Critical Limits needed to ensure no enterotoxin production by *Staphylococcus aureus* on the ham surface or inside the ham during a slow-cooking process

**CCP:** The United States Department of Agriculture (USDA) has cautioned against slow-cooking of meat such that the interior temperature increases from 50°F (10°C to 130°F (54.4°C) in  $\geq 6$  h. During one typical commercial ham-smoking process, the ham cold-point is typically between 50 and 130°F for 13 h, but is later heated enough to kill vegetative pathogenic bacteria (far exceeds USDA Appendix A guidelines). Thus, production of heat-stable staphylococcal enterotoxin is the primary biological hazard.

**Study Design:** Uncooked surface and uncooked ground interior ham were inoculated with a 3-strain *Staphylococcus aureus* mixture, exposed to simulated surface and interior slow-cook conditions, respectively, and analyzed periodically for numbers of *S. aureus* cells.

**Results and Discussion:** For the surface and interior conditions, respectively, *S. aureus* numbers increased by no more than 0.1 and 0.7 log units. Provided good sanitary conditions prevailed during pumping the hams, this minimal level of growth would not result in production of enterotoxin. Thus, the simulated cooking process can be considered safe.

**Validated Critical Limits** based on study results:

- Ham is pumped with brine to attain 18% weight gain,
- Pumped ham has 2.35% sodium lactate,
- Pumped ham has 0.8% sodium chloride, AND
- Pumped ham has at least 150 ppm sodium nitrite.

AND cooked so that the internal temperature is

- between 50 and 93°F for no more than 4 hours
- between 93 and 115°F for no more than 5 hours AND
- between 115 and 130°F for no more than 5 hours

**Reference: S.C. Ingham, J.A. Losinski, B.K. Dropp, L.L. Vivio, and D.R. Buege. 2004. Evaluation of *Staphylococcus aureus* growth potential in ham during a slow-cooking process: use of predictions derived from the U.S. Department of Agriculture Pathogen Modeling Program 6.1 Predictive Model and an inoculation study. *Journal of Food Protection*. 67:1512-1516.**

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For more information on this project or the work of the University of Wisconsin Center for Meat Process Validation contact: Barbara Ingham, Food Science Extension Specialist. [bingham@wisc.edu](mailto:bingham@wisc.edu) or 608-263-7383.

*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.*

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