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HACCP Validation

Validation is the process of demonstrating that the HACCP system as designed can adequately control identified hazards to produce a safe product. There are two distinct elements to validation:

- The scientific or technical justification or documented basis for the system. This consists of having scientific and technical documentation that demonstrate that the designed process can control the identified hazard. In other words, **will the HACCP work in theory?**, and

- The initial practical demonstration proving the system can perform as expected. This consists of having records which demonstrate the plan in operation, the HACCP plan achieves what is expected to achieve. In other words, **does the plan work in practice?**

Background

What is the responsibility of the establishment?

The establishment is responsible for all aspects of developing and implementing the HACCP plan including validation of the adequacy of the process that insures all food safety hazards are under control. The following describes what validation is.

What is the HACCP regulatory requirement for validation?

Section 417.4 of the meat and poultry regulations requires that each establishment validate the adequacy of its HACCP plans in controlling those food safety hazards identified during the hazard analysis. The hazard analysis must have supporting documentation for each step of a HACCP plan in order to show that the establishment accounts for all hazards likely to occur. Specifically, the processing steps that reduce, eliminate, or prevent food safety hazards - critical control points - and their accompanying critical limits must be validated. Initial validation contains the recorded documentation that shows that the HACCP plan functions as intended.

What type of documentation does FSIS expect for validation?

The documentation assembled to validate a HACCP plan are usually of two types:

- *HACCP design type of documentation:* Theoretical principles, expert advice from processing authorities, scientific data, or other information demonstrating that particular process control measures can adequately address specified hazards, and
- *HACCP execution type of documentation:* In-plant observations, data, measurements, test results, or other information demonstrating that the control measures, as written into a HACCP plan, can be operated within a particular establishment to achieve the intended food safety objective.

Validation data for any HACCP plan must include some practical data or information reflecting an establishment's actual experience in implementing the HACCP plan. This is because validation must demonstrate not only that the HACCP plan is theoretically sound, but also that the establishment can implement it and make it work on a day by day basis.

What are some examples of supporting documentation that may be used by the establishments to support the scientific design or technical justification or documented basis for their HACCP system?

- Scientific journal articles or other published scientific literature;
- FSIS regulations, or regulatory performance standards;
- FSIS compliance guidelines;
- FSIS directives;
- Industry standards or surveys;
- Trade association guidelines;
- Pathogen modeling programs;
- Processing authority documents, instructions, or research;
- Written information from industry experts or consultants;

- University extension publications;
- In-plant studies, research or historical data;
- Written materials from equipment manufacturers.

Resources

- **Information for Industry**

- **PowerPoint:** HACCP Systems Validation Industry Webinar [/sites/default/files/media_file/2020-11/haccp-validation-webinar-122115.pdf](https://www.fsis.usda.gov/sites/default/files/media_file/2020-11/haccp-validation-webinar-122115.pdf), December 21, 2015
- **PowerPoint:** Initial Validation Requirements: Understanding the FSIS Compliance Guideline for HACCP Systems Validation, Grocery Manufacturer's Association Webinar [/sites/default/files/media_file/2021-03/gma-haccp-validation-webinar.ppt](https://www.fsis.usda.gov/sites/default/files/media_file/2021-03/gma-haccp-validation-webinar.ppt), December 9, 2015

- **Instructions for FSIS Personnel**

- **Instructions for Verifying Validation Requirements During Performance of the Hazard Analysis Verification (HAV) Task**
FSIS Notice 32-17 reissues the instructions in FSIS Notice 78-15 for inspection program personnel (IPP) to follow when verifying compliance with validation requirements (9 CFR 417.4) as outlined in FSIS Directive 5000.6, Performance of the Hazard Analysis Verification (HAV) Task [/policy/fsis-directives/5000.6](https://www.fsis.usda.gov/policy/fsis-directives/5000.6).
- **FSIS Directive 5000.6 Performance of the Hazard Analysis Verification (HAV) Task** [/policy/fsis-directives/5000.6](https://www.fsis.usda.gov/policy/fsis-directives/5000.6)
This directive provides inspection program personnel (IPP) instructions for performing the Hazard Analysis Verification (HAV) task.

- **Training FSIS Provided on the Final HACCP Systems Validation Guidelines**

- **Video:** HACCP Validation Training <<https://youtu.be/o3zdtib0rbo>>

- **PowerPoint:** HACCP Systems Validation Training

</sites/default/files/media_file/2020-11/haccp-validation-webinar.pdf>

- **HACCP Systems Validation (May 14, 2015)**

- **Docket No. FSIS-2009-0019** <</policy/fsis-directives-and-notices/guidelines/fsis-compliance-guideline-haccp-systems-validation>>

- **FSIS Compliance Guideline HACCP Systems Validation** <</policy/fsis-directives-and-notices/guidelines/fsis-compliance-guideline-haccp-systems-validation>>

(April 2015)

- **HACCP Systems Validation Meeting**

Docket No. FSIS-2009-0019 </sites/default/files/media_file/2020-11/2013-12763.pdf> (May 29, 2013)

- **Regulatory Compliance Guides** <</policy/fsis-directives-notices/fsis-guidelines>>
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Helpful Web Sites

Note: *Links to sites outside USDA open in a new window.*

- University of Wisconsin, Center for Meat Process Validation

<http://meathaccp.wisc.edu/> <<http://meathaccp.wisc.edu/>>

- Ohio State University, Departments of Animal Sciences

<https://meatsci.osu.edu> <<https://meatsci.osu.edu>>

- Texas A&M University, Department of Meat Science

<https://meat.tamu.edu/> <<https://meat.tamu.edu/>>

- Kansas State University, Department of Animal Sciences and Industry
 - HACCP and Food Safety Help for Small Meat and Food Processing Operations
<https://www.asi.k-state.edu/research-and-extension/meat-science/haccp/haccp-assistance.html> <<https://www.asi.k-state.edu/research-and-extension/meat-science/haccp/haccp-assistance.html>>
- University of Nebraska-Lincoln, University of Nebraska Cooperative Extension
<http://foodsafety.unl.edu/> <<http://foodsafety.unl.edu/>>
- Penn State University, Department of Dairy and Animal Science
<http://foodsafety.psu.edu/> <<http://foodsafety.psu.edu/>>
- Iowa State University Meat Laboratory
<https://www.meatscience.ag.iastate.edu/meats-laboratory>
 <<https://www.meatscience.ag.iastate.edu/meats-laboratory>>
- Louisiana State University, Department of Food Science
http://www.lsuagcenter.com/en/our_offices/departments/Food_Science/ <http://www.lsuagcenter.com/en/our_offices/departments/food_science/>
- North Carolina State University, Department of Food, Bioprocessing and Nutrition Science, Cooperative Extension
https://fbns.ncsu.edu/extension_program/haccp.html
 <https://fbns.ncsu.edu/extension_program/haccp.html>
- Montana State University Extension
<http://extn.msu.montana.edu/> <<http://extn.msu.montana.edu/>>
- Utah State University Extension
<https://extension.usu.edu/foodbiz/> <<https://extension.usu.edu/foodbiz/>>
- University of Kentucky, Department of Animal & Food Sciences Food Science Program
<http://afs.ca.uky.edu/FoodScience> <<http://afs.ca.uky.edu/foodscience>>

- University of Florida, Department of Animal Sciences, Meat Extension
http://animal.ifas.ufl.edu/meat_extension/index.shtml
[<http://animal.ifas.ufl.edu/meat_extension/index.shtml>](http://animal.ifas.ufl.edu/meat_extension/index.shtml)
- Joint Institute of Food Safety and Applied Nutrition. The Institute is a jointly administered, multidisciplinary research and education program and includes research components from the FDA Centers for Food Safety and Applied Nutrition (CFSAN [<http://www.cfsan.fda.gov/>](http://www.cfsan.fda.gov/)) and Veterinary Medicine (CVM [<http://www.fda.gov/cvm/default.html>](http://www.fda.gov/cvm/default.html)), and University of Maryland [<http://www.umd.edu/>](http://www.umd.edu/).<http://www.jifsan.umd.edu/>
[<http://www.jifsan.umd.edu/>](http://www.jifsan.umd.edu/)

HACCP Coordinators

Coordinators are affiliated with Universities and provide additional one-on-one advice and assistance to small and very small plants related to HACCP and HACCP Validation. Coordinators also develop and provide training.

HACCP Coordinators may contact us with requests for updates or corrections to this list. [</contact-us/askfsis>](#)

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HACCP Validation by Product

Fermented Products | Salt-cured Products | Dried Products | Poultry
Products | Red Meat Products | Other

Fermented Products

Fermented Sausage

- Nickelson, R., II, J. Luchansky, C. Kaspar, and E. Johnson. 1996. Update on dry fermented sausage *Escherichia coli* O157:H7 validation research. Report No. 11-316. Available at:
https://meatsci.osu.edu/sites/meatsci/files/imce/1996_dry_fermented_sausage.pdf
<https://meatsci.osu.edu/sites/meatsci/files/imce/1996_dry_fermented_sausage.pdf>.

Summer Sausage

- Calicioglu, M., Faith, N.G., Buege, D.R., and Luchansky, J.B. 1997. Viability of *Escherichia coli* O157:H7 in Fermented Semi-dry Low-Temperature-Cooked Beef Summer Sausage. J. Food Prot. 60(1): 1158-1162. Available at:
<https://meridian.allenpress.com/jfp/article/60/10/1158/167793/Viability-of-Escherichia-coli-O157-H7-in-Fermented>
<<https://meridian.allenpress.com/jfp/article/60/10/1158/167793/viability-of-escherichia-coli-o157-h7-in-fermented>>.

Lebanon-Style Bologna

- Getty, K.J.K, Phebus, R.K, Marsden, J.L., Schwenke, J.R., and Kastner, C.L. 1999. Control of *Escherichia coli* O157:H7 in Large (115 mm) and Intermediate (90 mm) Diameter Lebanon-style Bologna. J. of Food Sci. 64(6): 1100-1107. Available at:
<https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1365-2621.1999.tb12290.x> <<https://onlinelibrary.wiley.com/doi/epdf/10.1111/j.1365-2621.1999.tb12290.x>>.

Salami

- Deibel Laboratories/CHR. Hansen. 2017. Fate of *Salmonella Spp.*, *Escherichia coli* O157:H7, *Listeria monocytogenes*, and *Staphylococcus aureus* Inoculated into a Non-Heated and Dried Salami Product. Available from CHR. Hansen Inc.
- Faith, N. G., Parniere, N., Larson, T., Lorang, T.D., Kaspar, C.W., Luchansky, J.B. 1998. Viability of *Escherichia coli* O157:H7 in salami following conditioning of batter, fermentation and drying of sticks, and storage of slices. J. Food Prot. 61:377-382. Available at: <https://meridian.allenpress.com/jfp/article/61/4/377/166976/Viability-of-Escherichia-coli-O157-H7-in-Salami>
<<https://meridian.allenpress.com/jfp/article/61/4/377/166976/viability-of-escherichia-coli-o157-h7-in-salami>>.
- Porto-Fett, A.C.S., Call, J.E., Shoyer, B.E., Hill, D.E., Pshebniski, C., Cocoma, G.J., and Luchansky, J.B. 2010. Evaluation of fermentation, drying, and/or high-pressure processing on viability of *Listeria monocytogenes*, *Escherichia coli* O157:H7, *Salmonella spp.*, and *Trichinella spiralis* in raw pork and Genoa salami. Int. Journal of Food Micro. 140: 61-75 </sites/default/files/media_file/2021-09/porto-fett-2010-high-pressure.pdf>.*

Pepperoni

- Hinkens, J.C., Faith, N.G., Lorang, T.D., Bailey, P., Buege, D., Kaspar, C.W., Luchansky, J.B. 1996. Validation of Pepperoni Processes for Control of *Escherichia coli* O157:H7. J. Food Prot. 59(12): 1260-1266. Available at: <https://meridian.allenpress.com/jfp/article/59/12/1260/167299/Validation-of-Pepperoni-Processes-for-Control-of>
<<https://meridian.allenpress.com/jfp/article/59/12/1260/167299/validation-of-pepperoni-processes-for-control-of>>.

- Ihnot, A.M., Roering, A.M., Wierzba, R.K., Faith, N.G., Luchansky, J.B. 1998. Behavior of *Salmonella typhimurium* DT104 during the manufacture and storage of pepperoni. International Journal of Food Microbiology. 40:117-121 </sites/default/files/media_file/2021-09/ihnot-1998.pdf>.
- Faith, N.G., Parniere, N., Larson, T., Lorang, T.D., Luchansky, J.B. 1997. Viability of *Escherichia coli* O157:H7 in pepperoni during the manufacture of sticks and subsequent storage of slices at 21, 4 and -20°C under air, vacuum and CO₂. Int. Journal of Food Micro. 37:47-54 </sites/default/files/media_file/2021-09/faith-1997.pdf>.

Soujouk

- Calicioglu, M., N. G. Faith, D. R. Buege, Luchansky, J.B. 2001. Validation of a Manufacturing Process for Fermented, Semidry Turkish Soudjouk to Control *Escherichia coli* O157:H7. J. Food Prot. 64(8):1156-1161. Available at: <https://meridian.allenpress.com/jfp/article/64/8/1156/170007/Validation-of-a-Manufacturing-Process-for> <<https://meridian.allenpress.com/jfp/article/64/8/1156/170007/validation-of-a-manufacturing-process-for>>.
- Calicioglu, M., N. G. Faith, D. R. Buege, Luchansky, J.B. 2002. Viability of *Escherichia coli* O157:H7 during manufacturing and storage of fermented, semidry soudjouk-style sausage. J. Food Prot. 65:1541-1544. Available at: <https://meridian.allenpress.com/jfp/article/65/10/1541/167136/Viability-of-Escherichia-coli-O157-H7-during> <<https://meridian.allenpress.com/jfp/article/65/10/1541/167136/viability-of-escherichia-coli-o157-h7-during>>.

- Porto-Fett, A.C.S., Hwang, C.A., Call, J.E., Juneja, V.K., Ingham, S.C., Ingham, B.H., Luchansky, J.B. 2008. Viability of multi-strain mixtures of *Listeria monocytogenes*, *Salmonella typhimurium*, or *Escherichia coli* O157:H7 inoculated into the batter or onto the surface of a soudjouk-style semi-dry sausage. Food Microbiology. 25: 793-801.*
Available at:
<https://meathaccp.wisc.edu/validation/assets/Dry%20Food%20Micro%2025.pdf> <<https://meathaccp.wisc.edu/validation/assets/dry%20food%20micro%2025.pdf>>.

Salt-cured Products

Basturma

- Ingham, S.C., Searls, G., Buege, D.R.. 2006. Inhibition of *Salmonella* serovars, *Escherichia coli* O157:H7, and *Listeria monocytogenes* during dry-curing and drying of meat: a case study with basturma. J. Food Safety 26: 160-172.* Available at:
<https://meathaccp.wisc.edu/validation/assets/Dry%20JFS%2026.pdf>
<<https://meathaccp.wisc.edu/validation/assets/dry%20jfs%2026.pdf>>.
- Genigeorgis, C., Lindroth, S. 1984. The Safety of Basturma, An Armenian-type Dried Beef Product with Regard to *Salmonella*. Proceedings of the 30th European Meeting of Meat Research Workers. Bristol, UK. 217-224.

Country Cured Ham

- Reynolds, A.E., Harrison, M.A., Rose-Morrow, R., Lyon, C.E. 2001. Validation of Dry Cured Ham Process for Control of Pathogens. J. Food Sci. 66:1373-1379. Abstract available at:
<https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-2621.2001.tb15217.X> <<https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-2621.2001.tb15217.x>>.

Dried Products

Droëwors

- Burnham, G.M., Hanson, D.J., Koshick, C.M., Ingham, S.C. 2008. Death of *Salmonella* Serovars, *Escherichia coli* O157:H7, *Staphylococcus aureus*, and *Listeria monocytogenes* During the Drying of Meat: A Case Study Using Biltong and Droewors. J. Food Safety. 28:198-209.*

Available at:

<https://meathaccp.wisc.edu/validation/assets/Dry%20JFS%2028.pdf>

<<https://meathaccp.wisc.edu/validation/assets/dry%20jfs%2028.pdf>>.

Biltong

- Burnham, G.M., Hanson, D.J., Koshick, C.M., Ingham, S.C. 2008. Death of *Salmonella* Serovars, *Escherichia coli* O157:H7, *Staphylococcus aureus*, and *Listeria monocytogenes* During the Drying of Meat: A Case Study Using Biltong and Droewors. J. Food Safety. 28:198-209.*

Available at:

<https://meathaccp.wisc.edu/validation/assets/Dry%20JFS%2028.pdf>

<<https://meathaccp.wisc.edu/validation/assets/dry%20jfs%2028.pdf>>.

- Karolenko, C.E., Bhusal, Ar., Nelson, J.L., Muriana, P.M. 2020. Processing of Biltong (Dried Beef) to Achieve USDA-FSIS 5-log Reduction of *Salmonella* Without a Heat Lethality Step. Microorganisms. 8(5): 791. Available at: <https://www.mdpi.com/2076-2607/8/5/791/htm> <<https://www.mdpi.com/2076-2607/8/5/791/htm>>.
- Naidoo, K., Lindsay, D. 2010. Survival of *Listeria monocytogenes*, and Enterotoxin-Producing *Staphylococcus aureus* and *Staphylococcus pasteurii*, During Two Types of Biltong-manufacturing Practices. Food Control. 21:1042-1050.*

Poultry

- Anonymous. Microbial intervention strategies for Salmonella and Campylobacter reduction in commercial turkey processing. Anonymous. Anonymous. 2005.
- E. del Rio, R. Muriente, and M. Proito. Effectiveness of Trisodium phosphate, acidified sodium chlorite, citric acid, and peroxyacetic acids against pathogenic bacteria on poultry during refrigerated storage. *J Food Prot* 70:2063-2071, 2007.
- D. L. Fletcher and E. W. Craig. An evaluation of on-line reprocessing on visual contamination and microbiological quality of broilers. *J Appl Poultry Res* 6:436-442, 1997.
- W. M. Fluckey, M. X. Sanchez, S. R. McKee, and et al. Establishment of a microbiological profile for an air-chilling poultry operation in the United States. *J Food Prot* 66:272-279, 2003.
- R. Fries. Reducing Salmonella transfer during industrial poultry meat production. *World's Poultry Science J* 58:527-540, 578-579, 582-583, 588, 593, 2002.
- W. O. James and J. C. Prucha. Effects of countercurrent scalding and postscald on the bacteriologic profile of raw chicken carcasses. *JAVMA* 201:705-708, 1992.
- G. K. Kemp, M. L. Aldrich, and A. L. Waldroup. Acidified sodium chlorite antimicrobial treatment of broiler carcasses. *J Food Prot* 63:1087-1092, 2001.
- G. K. Kemp, M. L. Aldrich, M. L. Guerra, and K. R. Schneider. Continuous online processing of fecal- and ingesta- contaminated poultry carcasses using an acidified chlorine antimicrobial intervention. *J Food Prot* 64:807-812, 2001.

- H. S. Lillard. Levels of chlorine and chlorine dioxide of equivalent bactericidal effect in poultry processing. *J Food Sci* 44:1594-1597, 1979.
 - J. K. Northcutt and D. P. Smith. Microbiological impact of spray washing broiler carcasses using different chlorine concentrations and water temperatures. *Poultry Sci* 84:1648-1652, 2005.
 - O. A. Oyarzabal. Reduction of campylobacter spp. by commercial antimicrobials applied during the processing of broiler chickens: a review from the US perspective. *J Food Prot* 68:1752-1760, 2005.
 - D. P. Smith, J. K. Northcutt, and M. T. Musgrove. Microbiology of contaminated or visibly clean broiler carcasses processed with an inside-outside bird washer. *Int J Poultry Sci* 4:955-958, 2005.
-

Red Meat

- T. Aymerich, P. A. Picouet, and J. M. Monfort. Decontamination technologies for meat products. *Meat Science* 78:114-129, 2008.
- R. T. Bacon, K. E. Belk, and J. N. Sofos. Microbial populations on animal hides and beef carcasses at different stages in plants employing multiple-sequential interventions and decontaminations. *J Food Prot* 63:1080-1086, 2000.
- E. Borch and P. Arinder. Bacteriological safety issues in red meat and ready-to-eat meat products, as well as control measures. *Meat Science* 62:381-390, 2003.
- J. M. Bosilevac, X. Nou, M. S. Osborne, and et al. Development and evaluation of an on-line hide decontamination procedure for use in a commercial beef processing plant. *J Food Prot* 68:265-272, 2005.
- J. R. Edwards and D. Y. C. Fung. Prevention and decontamination of *E. coli* O157:H7 on raw beef carcasses in commercial beef abattoirs. *J Rapid Methods and Automation in Microbiology* 14:1-95, 2006.

- B. L. Farrell, A. B. Ronner, and A. C. L. Wong. Attachment of *Escherichia coli* O157:H7 in ground beef to meat grinders and survival after sanitation with chlorine and peroxyacetic acid. *J Food Prot* 61:817-822, 1998.
- K. Harris, M. F. Miller, and G. H. Loneragan. Validation of the use of organic acids and acidified sodium chlorite to reduce *Escherichia coli* O157:H7 and *Salmonella Typhimurium* in beef trim and ground beef in a simulated processing environment. *J Food Prot* 69:1802-1807, 2008.
- R. D. Huffman. Current and future technologies for the decontamination of carcasses and fresh meat. *Meat Science* 62:285-294, 2002.
- M. Hugas, M. Garriga, and J. M. Monfort. New mild technologies in meat processing: high pressure as a model technology. *Meat Science* 62:359-371, 2002.
- N. Kalchayanand, T. M. Arthur, and J. M. Bosilevac. Evaluation of various antimicrobial interventions for the reduction of *Escherichia coli* O157:H7 on beef heads during processing. *J Food Prot* 71:621-624, 2008.
- S. L. Kochevar, Sofos JN, S. B. LeValley, and G. C. Smith. Effect of water temperature, pressure and chemical solution on removal of fecal material and bacteria from lamb adipose tissue by spray-washing. *Meat Science* 45:377-388, 1997.
- S. E. Niebuhr, A. Laury, G. R. Acuff, and J. S. Dickson. Evaluation of nonpathogenic surrogate bacteria as process validation indicators for *Salmonella enterica* for selected antimicrobial treatments, cold storage, and fermentation in meat. *J Food Prot* 71:714-718, 2008.
- X. Nou, M. Rivera-Betancourt, J. M. Bosilevac, and et al. Effect of chemical dehairing on the prevalence of *Escherichia coli* O157:H7 and the levels of aerobic bacteria and enterobacteriaceae on carcasses in a commercial beef processing plant. *J Food Prot* 66:2005-2009, 2003.

- J. R. Ransom, K. E. Belk, J. N. Sofos, and et al. Comparison of intervention technologies for reducing *Escherichia coli* O157:H7 pm beef cuts and trimmings. *Food Protection Trends* 23:24-34, 2003.
 - J. A. Scanga, A. D. Grona, K. E. Belk, and et al. Microbiological contamination of raw beef trimmings and ground beef. *Meat Science* 56:145-152, 2002.
 - M. R. Stivariusn, F. W. Pohlman, K. S. McElyea, and J. K. Apple. Microbial, instrumental color and sensory color and odor characteristics of ground beef produced from beef trimmings treated with ozone or chlorine dioxide. *Meat Science* 60:299-305, 2003.
 - D. R. Woerner and et al. Preharvest processes for microbial control in cattle. *Food Protection Trends* 26:393-400, 2006.
-

Other

- V. M. Allen, M. H. Hinton, and D. B. Tinker. Microbial cross-contamination by airborne dispersion and contagion during defeathering of poultry. *Brit Poult Sci* 44:567-576, 2005.
- S. P. Axtell and et al. Effect of immersion chilling of broiler chicken carcasses in monochloramine on lipid oxidation and halogenated residual compound formation. *J Food Prot* 69:907-911, 2006.
- G. V. Barbosa-Canovas and J. J. Rodriguez. Update on nonthermal food processing technologies: pulsed electric field, high hydrostatic pressure, irradiation and ultrasound. *Food Australia* 54:513-520, 2002.
- T. R. Callaway, R. C. Anderson, T. S. Edrington, and et al. Preslaughter intervention strategies to reduce food-borne pathogens in food animals. *J Anim Sci* 81:E170E23, 2003.
- A. Castillo, J. S. Dickson, and R. P. Clayton. Chemical dehairing of bovine skin to reduce pathogenic bacteria and bacteria of fecal origin. *J Food Prot* 61:623-625, 1998.

- E. del Rio, R. Capita, M. Prieto, and C. Alonso-Calle. Comparison of pathogenic and spoilage bacterial levels on refrigerated poultry parts following treatment with trisodium phosphate. *Food Microbiol* 23:195-198, 2006.
- E. del Rio, B. G. de Caso, and M. Prieto. Effect of poultry decontaminants concentration on growth kinetics for pathogenic and spoilage bacteria. *Food Microbiol* 25:888-894, 2008.
- C. Garcia-Graells, I. V. Opstal, S. C. M. Vanmuysen, and C. W. Michiels. The lactoperoxidase system increases efficacy of high-pressure inactivation of foodborne bacteria. *Int J Food Microbiol* 81:211, 2003.
- D. R. Korber, G. G. Greer, G. M. Wolfaardt, and et al. Efficacy of enhancement of trisodium phosphate against spoilage and pathogenic bacteria in model biofilms and on adipose tissue. *J Food Prot* 65:627-635, 2002.
- S. Quintavall and L. Vicini. Antimicrobial food packaging in meat industry. *Meat Science* 62:373-380, 2002.
- J Yuste, M. Capellas, D. Y. C. Fung, and et al. Inactivation and sublethal injury of foodborne pathogens by high pressure processing: evaluation with conventional media and thin layer method. *Food Research International* 37:861-866, 2004.

* Study did not achieve a 5-log reduction in *Salmonella*, Shiga-toxin producing *Escherichia coli* (STEC), or *Listeria monocytogenes* so additional supporting documentation should be provided.

HACCP Validation by Pathogens

Campylobacter

- Anonymous. Microbial intervention strategies for *Salmonella* and *Campylobacter* reduction in commercial turkey processing. Anonymous. Anonymous. 2005.
- M. E. Berrang, J. A. Dickens, and M. T. Musgrove. Effects of hot water application after defeathering on the levels of *Campylobacter*, coliform bacteria, and *Escherichia coli* on broiler carcasses. *Poultry Sci* 79:1689-1693, 2000.
- P. L. White, A. R. Baker, and W. O. James. Strategies to control *Salmonella* and *Campylobacter* in raw poultry products. *Rev Sci Off Int Epiz* 16:525-541, 1997.
- Y. Yang and M. G. Johnson. Predictive models for the survival/death of *Campylobacter jejuni* and *Salmonella Typhimurium* in poultry scalding and chilling. *J Food Sci* 67:1836-1843, 2002.
- L. Y. Yang and B. L. Swem. Effect of high-temperature inside-outside spray on survival of *Campylobacter jejuni* attached to prechill chicken carcasses. *Poultry Sci* 81:1371-1377, 2002.

E. coli 0157:H7

- J. D. Berg and A. Matin. Effect of chlorine dioxide on selected membrane functions of *Escherichia coli*. *J Appl Bacteriol* 60:213-220, 1986.

- M. E. Berrang, J. A. Dickens, and M. T. Musgrove. Effects of hot water application after defeathering on the levels of *Campylobacter*, coliform bacteria, and *Escherichia coli* on broiler carcasses. *Poultry Sci* 79:1689-1693, 2000.
- J. M. Bosilevac, X. Nou, and G. A. Barkocy-Gallagher. Treatments using hot water instead of lactic acid reduce levels of aerobic bacteria and Enterobacteriaceae and reduce prevalence of *Escherichia coli* O157:H7 on previsceration beef carcasses. *J Food Prot* 69:1808-1813, 2006.
- A. Castillo, L. M Lucia, G. K. Kemp, and G. R. Acuff. Reduction of *Escherichia coli* O157:H7 and *Salmonella typhimurium* on beef carcasses using acidified sodium chlorite. *J Food Prot* (580):584, 1999.
- J. R. Edwards and D. Y. C. Fung. Prevention and decontamination of *E. coli* O157:H7 on raw beef carcasses in commercial beef abattoirs. *J Rapid Methods and Automation in Microbiology* 14:1-95, 2006.
- B. L. Farrell, A. B. Ronner, and A. C. L. Wong. Attachment of *Escherichia coli* O157:H7 in ground beef to meat grinders and survival after sanitation with chlorine and peroxyacetic acid. *J Food Prot* 61:817-822, 1998.
- R. Fries. Reducing *Salmonella* transfer during industrial poultry meat production. *World's Poultry Science J* 58:527-540, 578-579, 582-583, 588, 593, 2002.
- K. Harris, M. F. Miller, and G. H. Loneragan. Validation of the use of organic acids and acidified sodium chlorite to reduce *Escherichia coli* O157:H7 and *Salmonella Typhimurium* in beef trim and ground beef in a simulated processing environment. *J Food Prot* 69:1802-1807, 2008.
- N. Kalchayanand, T. M. Arthur, and J. M. Bosilevac. Evaluation of various antimicrobial interventions for the reduction of *Escherichia coli* O157:H7 on beef heads during processing. *J Food Prot* 71:621-624, 2008.

- L. Levanduski and J. Jaczynski. Increased resistance of *Escherichia coli* O157:H7 to electron beam following repetitive irradiation at sub-lethal doses. *Int J Food Microbiol* 121:328-334, 2008.
 - G. H. Loneragan and M. M. Brashears. Pre-harvest interventions to reduce carriage of *E. coli* O157:H7 by harvest-ready feedlot cattle. *Meat Science* 71:72-78, 2005.
 - X. Nou, M. Rivera-Betancourt, J. M. Bosilevac, and et al. Effect of chemical dehairing on the prevalence of *Escherichia coli* O157:H7 and the levels of aerobic bacteria and enterobacteriaceae on carcasses in a commercial beef processing plant. *J Food Prot* 66:2005-2009, 2003.
 - J. R. Ransom, K. E. Belk, J. N. Sofos, and et al. Comparison of intervention technologies for reducing *Escherichia coli* O157:H7 pm beef cuts and trimmings. *Food Protection Trends* 23:24-34, 2003.
 - K. V. Sy, M. B. Murry, and et al. Evaluation of gaseous chlorine dioxide as a sanitizer for killing *Salmonella*, *Escherichia coli* O157:H7, *Listeria monocytogenes*, and yeasts and molds on fresh and fresh-cut produce. *J Food Prot* 68:1176-1187, 2005.
 - B. A. Vanselow, D. O. Krause, and C. S. McSweeney. The shiga toxin-producing *Escherichia coli*, their ruminant hosts, and potential on-farm interventions: a review. *Australian j Agri Res* 56:219-244, 2005.
 - J. D. F. Wadsworth and Asan. Evaluation of peroxyacetic acid as a post-chilling intervention for control of *Escherichia coli* O157:H7 and *Salmonella typhimurium* on beef carcass surfaces. *Meat Science* 69:401-407, 2005.
-

Listeria monocytogenes

- R. Capita, C Alonso-Calleja, and M. et al Prieto. Effectiveness of trisodium phosphate against *Listeria monocytogenes* on excised and nonexcised chicken skin. *J Food Prot* 66:61-64, 2003.
- R. Y. Murphy and M. E. Berrang. Thermal lethality of *Salmonella senftenberg* and *Listeria innocua* on fully cooked and vacuum packaged chicken breast strips during hot dog water pasteurization. *J Food Prot* 65:1561-1564, 2002.
- H. Ozdemir, A. Gucukoglu, and S. Pamuk. Effects of cetylpyridinium chloride, lactic acid and sodium benzoate on populations of *Listeria monocytogenes* and *Staphylococcus* in beef. *J Food Safety* 26:41-48, 2006.
- K. V. Sy, M. B. Murry, and et al. Evaluation of gaseous chlorine dioxide as a sanitizer for killing *Salmonella*, *Escherichia coli* O157:H7, *Listeria monocytogenes*, and yeasts and molds on fresh and fresh-cut produce. *J Food Prot* 68:1176-1187, 2005.

Salmonella

- P. L. White, A. R. Baker, and W. O. James. Strategies to control *Salmonella* and **Campylobacter** in raw poultry products. *Rev Sci Off Int Epiz* 16:525-541, 1997.
- D. A. Barber, P. B. Bahnson, R. Isaacson, and et al. Distribution of *Salmonella* in swine distribution system. *J Food Prot* 65:1861-1868, 2002.

- A. Castillo, L. M Lucia, G. K. Kemp, and G. R. Acuff. Reduction of *Escherichia coli* O157:H7 and *Salmonella typhimurium* on beef carcasses using acidified sodium chlorite. *J Food Prot* (580):584, 1999.
- A. Castillo, L. M Lucia, G. K. Kemp, and G. R. Acuff. Reduction of *Escherichia coli* O157:H7 and *Salmonella typhimurium* on beef carcasses using acidified sodium chlorite. *J Food Prot* (580):584, 1999.
- K. A. Fabrizio, R. R. Sharma, A. Demirci, and C. N. Cutter. Comparison of electrolyzed oxidizing water with various antimicrobial interventions to reduce *Salmonella* species on poultry. *Poultry Sci* 81:1598-1605, 2002.
- K. Harris, M. F. Miller, and G. H. Loneragan. Validation of the use of organic acids and acidified sodium chlorite to reduce *Escherichia coli* O157:H7 and *Salmonella typhimurium* in beef trim and ground beef in a simulated processing environment. *J Food Prot* 69:1802-1807, 2008.
- D. R. Korber, C. L. Choi, G. M. Wolfaardt, and et al. Substratum topography influences susceptibility of *Salmonella enteritidis* biofilms to trisodium phosphate. *Appl Environ Microbiol* (3352):3358, 1997.
- R. Y. Murphy and M. E. Berrang. Thermal lethality of *Salmonella senftenberg* and *Listeria innocua* on fully cooked and vacuum packaged chicken breast strips during hot dog water pasteurization. *J Food Prot* 65:1561-1564, 2002.
- S. E. Niebuhr, A. Laury, G. R. Acuff, and J. S. Dickson. Evaluation of nonpathogenic surrogate bacteria as process validation indicators for *Salmonella enterica* for selected antimicrobial treatments, cold storage, and fermentation in meat. *J Food Prot* 71:714-718, 2008.
- J. R. Ruby, J. Zhu, and S. C. Ingham. Using indicator bacteria and *Salmonella* test results from three large-scale beef abattoirs over an 18-month period to evaluate intervention system efficacy and plan carcass testing for *Salmonella*. *J Food Prot* 70:2732-2740, 2007.

- B. Sampathkumar, G. G. Khachatourians, and D. R. Korber. High pH during trisodium phosphate treatment causes membrane damage and destruction of *Salmonella enterica* Serovar Enteritidis. *Appl Environ Microbiol* 69:122-129, 2003.
 - K. V. Sy, M. B. Murry, and et al. Evaluation of gaseous chlorine dioxide as a sanitizer for killing *Salmonella*, *Escherichia coli* O157:H7, *Listeria monocytogenes*, and yeasts and molds on fresh and fresh-cut produce. *J Food Prot* 68:1176-1187, 2005.
 - M. E. Villarreal, R. C. Baker, and J. M. Regenstein. The incidence of *Salmonella* on poultry carcasses following the use of slow release chlorine dioxide (Alcide). *J Food Prot* 53:465-467, 1990.
 - J. D. F. Wadsworth and Asan. Evaluation of peroxyacetic acid as a post-chilling intervention for control of *Escherichia coli* O157:H7 and *Salmonella typhimurium* on beef carcass surfaces. *Meat Science* 69:401-407, 2005.
 - P. L. White, A. R. Baker, and W. O. James. Strategies to control *Salmonella* and *Campylobacter* in raw poultry products. *Rev Sci Off Int Epiz* 16:525-541, 1997.
-