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Comments of Consumers Union on U.S. Department of Agriculture Food Safety Inspection Service's Proposed Rule: Descriptive Designation for Needle- or Blade-Tenderized (Mechanically Tenderized) Beef Products, Docket No. FSIS-2008-0017

Summary

Consumers Union[1] (CU) welcomes the opportunity to comment on the United States Department of Agriculture (USDA) Food Safety Inspection Service's (FSIS) decision to require that "mechanically tenderized" beef products be labeled as "mechanically tenderized," and to require that the labels include validated cooking instructions regarding cooking to a specified minimum internal temperature, and regarding holding these products for a specified time after cooking and before eating.

We commend FSIS for recognizing that mechanically tenderized beef products do present a higher food safety risk to consumers compared to their non-mechanically-tenderized counterparts due to the fact that pathogenic bacteria such as *E. coli* O157:H7 or other shiga toxin-producing *E. coli* (e.g. STECs) can be forced from the surface into the interior of such products and so may not be killed sufficiently, and that such products should be labeled as "mechanically tenderized" and should contain specific information on safe cooking. We also support FSIS' plan to conduct a public education campaign to explain the significance of the term "mechanically tenderized" to consumers.

We have concerns about specific aspects of the proposed labeling. First, we believe that the words "mechanically tenderized" and the cooking instruction should be highlighted in some way (e.g. by putting that information on a brightly colored sticker,

[1] *Consumers Union is the public policy and advocacy division of Consumer Reports. Consumers Union works for telecommunications reform, health reform, food and product safety, financial reform, and other consumer issues. Consumer Reports is the world's largest independent product-testing organization. Using its more than 50 labs, auto test center, and survey research center, the nonprofit rates thousands of products and services annually. Founded in 1936, Consumer Reports has over 8 million subscribers to its magazine, website, and other publications .*

placed immediately below the current label) to draw attention to the fact the product is different than the non-mechanically-tenderized (i.e. intact) product.

Second, while we agree with FSIS that the cooking instructions should be validated, we recommend that the instructions be somewhat different from what FSIS has proposed. We agree with FSIS that the validated cooking instructions should include the cooking method; a minimum internal temperature validated to ensure that potential pathogens are destroyed throughout the product; and instruction to use a thermometer to measure the internal temperature. The minimum internal temperature for all MTB products should be 160 ºF.

However, we question whether the label should contain any recommendation that the product needs to be held for a specified time at a particular temperature (e.g. cook to internal temperature of 145 ºF (or 62.8 ºC) and hold for three minutes), as we think it is impractical to request consumers to hold cooked product, especially steaks, for a period of time prior to consumption. In addition, the study on which that recommendation is based appears, on closer examination, not to support it. Thus, labels for MTB products should not include a rest time, unless there are significant data to support it. Rather, in our view, the label should advise that mechanically tenderized steaks should be cooked to an internal temperature of 160 º F and be turned more than once, in light of a new study that has found that mechanically tenderized steaks cooked to an internal temperature of 160 º F had to be turned over more than once to ensure that potential pathogens are destroyed throughout the product.

We also urge FSIS to update its risk assessment of mechanically tenderized beef (MTB) products and release it for public comment. Because the increase in food safety risk for MTB occurs in the processing plant, FSIS should require that processors include an intervention step—such as use of hot water washes, lactic acid bacteria, or lactic acid washes—to reduce the bacterial levels on the beef product just prior to mechanical tenderization or injection with marinade or solution.

More detailed comments are below.

Background

As the proposed rule notes, research has shown that consumers consider product tenderness to be a key factor when buying meat products, with tenderness of a roast or steak being a key selling point for the meat industry. To improve the tenderness of less tender cuts of beef, and thereby increase their marketability, companies use a variety of means to mechanically tenderize meat products, typically piercing the product with a set of needles or blades.

Studies have shown that the process of mechanical tenderization can transfer pathogens such as *E. coli* or *Salmonella* from the surface to the interior of the product.[2] Normally, if a pathogen occurs on the surface of an intact muscle cut, such as a steak, that pathogen will be immediately killed during cooking. However, in MTB, these pathogens may have been transferred into the interior of the steak and so may not be killed during cooking. Thus, eating a mechanically tenderized steak may increase the risk of illness compared to eating an intact steak.

FSIS Should Update its Risk Assessment

In March 2002 USDA FSIS published its risk assessment for mechanically tenderized beef (MTB) products, which concluded that "there is almost no difference in the risk of illness from intact (not tenderized) versus non-intact (tenderized) steaks," and "the probability of *E. coli* O157:H7 surviving typical cooking practices in either tenderized or not-tenderized steaks, is miniscule."[3] This finding was based, in part, on the fact that as of 2002 there had only been one reported outbreak of *E. coli* O157:H7 associated with MTB.[4]

Since the publication of that risk assessment for MTB products, however, the Centers for Disease Control and Prevention has received reports of five additional outbreaks of *E. coli* O157:H7 attributable to needle- or blade-tenderized beef products prepared in restaurants and consumers' homes. Among these five outbreaks, there were a total of 174 *E. coli* O157:H7 cases resulting in 32 hospitalizations and 4 cases of hemolytic uremic syndrome (HUS).[5] In addition to the six outbreaks of *E. coli* O157:H7 attributable to needle- or blade-tenderized beef in the US since 2000, there also was an outbreak of *E. coli* O157:H7 likely attributable to mechanically-tenderized beef in Canada in 2012. The 2012 Canadian outbreak involved beef products produced by XL Foods Inc. and involved 18 cases of *E. coli* O157:H7; FSIS determined that US companies received 2.5 million pounds of the implicated beef products produced by XL Foods Inc.[6]

It also appears that mechanical tenderization is an increasingly common practice in the beef industry. A 2012 report by RTI International estimates that 26.3% of all raw

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[2] Luchansky JB, Phebus RK, Thippareddi and JE Call. 2008. Translocation of surface-inoculated *Escherichia coli* O157:H7 into beef supbprimals following blade tenderization. *Journal of Food Protection*, 71(11): 2190-2197.

[3] Pp. 12, 13 in USDA-FSIS (United States Department of Agriculture-Food Safety Inspection Service). 2002. *Comparative Risk Assessment for Intact (Non-Tenderized) and Non-Intact (Tenderized) Beef: Executive Summary*. At: http://www.fsis.usda.gov/wps/wcm/connect/7afddc93-f812-42fb-92b7-52455124bbe0/Beef_Risk_Assess_ExecSumm_Mar2002.pdf?MOD=AJPERES

[4] Table 2, pg. 34592 in FSIS. 2013. 9 CFR Part 317 [Docket No. FSIS–2008–0017]. Descriptive Designation for Needle- or Blade-Tenderized (Mechanically Tenderized) Beef Products. 78 *Federal Register*, No. 111, Monday, June 10, 2013. At: http://www.regulations.gov/#!documentDetail;D=FSIS-2008-0017-0001

[5] Table 2 in IBID.

[6] Lewis RJ, Corriveau A and WR Usborne. 2013. Independent Review of XL Foods Inc. Beef Recall. At: http://www.foodsafety.gc.ca/english/xl_reprt-rapprte.asp

beef products are mechanically tenderized,[7] while FSIS, in its proposed rule, estimates that MTB is served 6.2 billion times annually.

We are also concerned that the use of beta-andrenergic agonists—such as zilpaterol (Zilmax) or ractopamine (Optiflex)—for growth promotion purposes in cattle, may increase toughness of the meat, which, in turn, could lead to increased use of mechanical tenderization. An article published last year noted:

> As the cattle trucked to the packing plants have grown into bulky, lumbering giants, the quality of the beef has plummeted. Meat from the most pharmaceutically enhanced cattle—especially those given Zilmax—can be so tough that some packing plants are refusing to buy cattle fed the drug. Some cattlemen and beef-industry executives have also begun to speak out. They warn that continued use of the drug may make ranchers' herds difficult to sell, and end up hurting the image of American beef.[8]

Increased use of zilpaterol, thus, could lead to increased use of mechanical tenderization, with a concomitant increase in food safety risk for consumers.

In contrast to the seven outbreaks of *E. coli* O157:H7 attributable to needle- or blade-tenderized beef products in US and Canada since 2000, the proposed rule notes that "To date, no outbreaks or sporadic illnesses from consuming intact product have been reported to CDC." Clearly, eating MTB products increases the risk of illness compared to consuming intact beef products. A paper published earlier this year, by scientists from Health Canada and the Public Health Agency of Canada found that "the consumption of MTB is approximately 5 times riskier than consumption of an intact beef cut."[9] In light of this new evidence, FSIS has announced that they will update their risk assessment for MTB. We urge FSIS to publish their updated risk assessment for MTB as soon as possible for public comment**.**

Processors Should Mitigate Risk of Contamination

Because the process of mechanical tenderization increases the food safety risk of the beef product, we believe that FSIS should take appropriate steps to mitigate those risks. Those steps should include changes in the tenderization process itself as well as

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[7] Table 3-11 on pg. 3-17 in Muth MK, Ball M and MC Coglaiti. 2012. Expert Elicitation on the Market Shares for Raw Meat and Poultry Products Containing Added Solutions and Mechanically Tenderized Raw Meat and Poultry Products. RTI International. Research Triangle Park, NC. 59pp. At: http://www.fsis.usda.gov/wps/wcm/connect/3a97f0b5-b523-4225-8387-c56a1eeee189/Market_Shares_MTB_0212.pdf?MOD=AJPERES

[8] Petersen, M. 2012. As beef cattle become behemoths, who are animal scientists serving? *The Chronicle of Higher Education*. At: http://chronicle.com/article/As-Beef-Cattle-Become/131480/

[9] Pg. 1,2 in Catford A, Lavoie M-C, Smith B, Buenaventura E, Couture H, Fazil A and JM Farber. 2013. Findings of the health risk assessment of *Escherichia coli* O157 in mechanically tenderized beef products in Canada. *International Food Risk Analysis Journal*, 3(2): 1-12. At: http://cdn.intechopen.com/pdfs/45126/InTech-Findings_of_the_health_risk_assessment_of_escherichia_coli_o157_in_mechanically_tenderized_beef_products_in_canada.pdf

changes in recommended consumer behavior. FSIS should require processors (either production plants or retailers) to undertake some intervention to reduce bacterial levels on the raw or partially cooked beef product just prior to mechanical tenderization.

A study published in 2007 looked at the effect of five interventions—surface trimming, hot water (82 º C), warm 2.5% lactic acid solution (55 º C), warm 5% lactic acid solution (55 º C), and 2% lactoferrin followed by warm 5% lactic acid solution (55 º C)—just prior to needle or blade tenderization. It found that each of these interventions led to a roughly 10-fold reduction in surface levels and significant reduction in internal levels of *E. coli* O157:H7, concluding "that interventions applied before mechanical tenderization can effectively reduce the transfer of low concentrations of *E. coli* O157:H7 to the interior of beef subprimal cuts."[10] Another study published in 2010 looked at interventions involving use of lactic acid bacteria, lactic acid sprays and acidified sodium chlorite and found that lactic acid bacteria and lactic acid sprays were significantly better than acidified sodium chlorite at reducing internal levels of *E. coli* O157:H7 in inoculated USDA Choice strip loins prior to mechanical tenderization, concluding that "application of antimicrobials by purveyors prior to mechanical tenderization or enhancement of steaks should increase the safety of these types of products."[11]

Although FSIS has published a notice requiring establishments producing MTB products to reassess their hazard analysis and critical control point systems (HACCP), we urge FSIS to go one step further and require processors to have a decontamination step—with hot water or use of antimicrobials—to reduce pathogens just prior to mechanical tenderization.

MTB Products Should Be Prominently and Uniformly Labeled

At the consumer level, consumers must be informed that MTB products have a higher food safety risk compared to intact beef products and that they must be cooked more thoroughly than intact beef products. However, mechanically tenderized products usually have no visible signs of having been mechanically tenderized and neither processors nor retailers generally provide information to indicate that fact. Without labeling, purchasers—both at-home cooks and foodservice establishments—have no way of knowing which products are MTB products and must therefore be cooked more thoroughly in order to minimize the risk of illness, and which products are intact and therefore will likely be rendered safe through surface searing.

We agree with FSIS that MTB products must be labeled to indicate that they have been mechanically tenderized and to indicate that they must be cooked more thoroughly.

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[10] Pg. 1174 in Heller CE, Scanga JA, Sofos JN, Belk KE, Warren-Serna W, Bellinger GR, Bacon RT, Rossman ML and GC Smith. 2007. Decontamination of beef subprimal cuts intended for blade tenderization or moisture enhancement. *Journal of Food Protection*, 70(5): 1174-1180.

[11] Pg. 2169 in Echeverry A, Brooks JC, Miller MF, Collins JA, Loneragan GH and MM Brashears. 2010. Validation of lactic acid bacteria, lactic acid, and acidified sodium chlorite as decontaminating interventions to control *Escherichia coli* O157:H7 and *Salmonella Typhimurium* DT 104 in mechanically tenderized and brine-enhanced (nonintact) beef at the purveyor. *Journal of Food Protection*, 73(12): 2169-2179.

We also agree that the term "mechanically tenderized" should be the descriptive term used on the label of raw or partially cooked needle- or blade-tenderized beef products, as this term accurately and truthfully describes the nature of the product. We also agree with FSIS that the definition of "mechanically tenderized" beef products should be those "products that have been needle- or blade-tenderized, or have only been injected with a marinade or solution" and that this definition should be incorporated into the regulations.

FSIS' current proposal would allow producers to choose a method of labeling that best suits their unique product packaging. We urge instead that FSIS select a single, standardized method for labeling and require it of all producers of MTB. To reduce consumer confusion and make it clear to consumers that beef products have been mechanically tenderized, we recommend that the label should be a brightly colored sticker, separate from the existing label on the package, and placed immediately beneath that existing label. Such a brightly colored sticker would be more likely to be seen by consumers. The label should include the words "mechanically tenderized" as well as validated cooking instruction specific to the particular MTB product**.**

Proposed Validated Cooking Instructions Should Be Strengthened

We agree with FSIS' proposal to require validated cooking instructions on the label of MTB products. FSIS has proposed that such validated cooking instructions should contain, at minimum, four types of information: 1) cooking method, 2) minimum internal temperature validated to ensure that potential pathogens are destroyed throughout the product; 3) whether the product needs to be held for a specified time at that temperature or higher before consumption; and 4) instruction to use a thermometer to measure internal temperature.

We agree with FSIS that the validated cooking instruction should include the cooking method because consumers need explicit information about how to cook a product in order to ensure that it is safe for consumption. We also agree "that cooking instructions must be validated to ensure that potential pathogens are destroyed throughout the product as determined by the specified minimum internal temperature."

145 ºF and 3 Minutes is Not Enough

However, we disagree with FSIS' recommendation that "mechanically tenderized beef products should be cooked to 145 ºF with a three-minute dwell time because it will result in a 5.0-log reduction of *Salmonella* throughout the product." FSIS bases this recommendation on a study published in 1978[12] and the fact that *Salmonella* is more heat-resistant than *E. coli* O157:H7, reasoning that "if a 5.0-log reduction of *Salmonella* is achieved, at least a 5.0-log reduction of *E. coli* O157:H7 should be achieved as well." However, this recommendation does not take into account two recently published studies.

[12] Goodfellow SJ and WL Brown. 1978. Fate of *Salmonella* inoculated into beef for cooking. *Journal of Food Protection*, 41: 598-605.

One of these more recent studies, published in the September 2013 issue of *Journal of Food Protection*, tested ground beef. It looked at inactivation of *E. coli* O157:H7 and non-O157 shiga toxin producing *E. coli* (STEC) within refrigerated, frozen, or frozen then thawed ground beef patties inoculated with *E. coli* O157:H7 and non-O157 STEC.[13] The ground beef patties in this study were cooked to internal temperatures of 60 ºC (140 ºF), 65.6 ºC (150 ºF), 71.1 ºC (160 ºF) and 76.7 ºC (170 ºF). The study concluded that "it was possible to achieve a ≥5.0-log CFU/g reduction of either *E. coli* O157:H7 or STEC when patties were heated to internal temperatures of 71.1 [160] and 76.6 ºF [sic] [170 ºF]."[14]

This study clearly shows cooking a frozen or refrigerated ground beef patty to 150 ºF was not sufficient to result in a ≥5.0-log reduction of *E. coli* O157:H7. Although this study was done with ground beef patties, MTB products, like ground beef, are nonintact and can be internally contaminated. In addition, MTB products, especially steaks, are often sold or stored frozen. Although there have been no similar studies conducted using refrigerated or frozen MTB products, especially steaks, we believe that the conclusions from this study are equally relevant for MTB products. In addition, FSIS should recommend on the label that any frozen MTB products, particularly steaks, should be fully thawed prior to cooking.

Steaks Should be Flipped at Least Twice

The other recently published study looked at the survival of *E. coli* O157:H7 in mechanically tenderized steaks depending on how many times they are turned over (i.e. flipped) during grilling. This study found that the frequency of turning over steaks during grilling (and the time that lapses before turning over) is actually key, and it throws into question the notion that 145 ºF + 3 min holding time is sufficient.[15] This study used MTB steaks from 1 cm to 3 cm thick, put on a grill straight from the refrigerator. (According to another study, Canadian steaks consumed in North America average about 2 cm thick.[16]) The study found that if a steak is turned over only once, then grilling even to an internal temperature of 160 ºF (71 ºC) may not be enough, especially if the 2 cm steak is turned over sooner than 10 minutes. While the center temperature might reach 160 ºF in that situation, a point closer to the edges of the steak might still be at a lower temperature. Indeed, if a 2 cm-thick steak is inoculated with *E. coli* O157:H7, cooked to center temperature of160 ºF, but is turned over only once, after 8 minutes, *E. coli* is found in the center of 2 of 5 steaks (e.g. in 3 steaks all the *E. coli* are destroyed), yet is found in

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[13] Luchansky JB, Porto-Fett ACS, Shoyer BA, Phillips J, Chen V, Eblen DR, Cook V, Mohr TB, Esteban E and N Bauer. 2013. Fate of shiga toxin-producing O157:H7 and non-O157:H7 *Escherichia coli* cells within refrigerated, frozen, or frozen then thawed ground beef patties cooked on a commercial open-flame gas or a clamshell electric grill. *Journal of Food Protection*, 76(9): 1500-1512.

[14] Pg. 1511 in IBID.

[15] Gill CO, Yang X, Uttaro B, Badoni M and T Liu. 2013. Effects on survival of *Escherichia coli* O157:H7 in non-intact steaks of the frequency of turning over steaks during grilling. *Journal of Food Research*, 2(5): 77-89. At: http://www.ccsenet.org/journal/index.php/jfr/article/view/28980/17699

[16] Juarez M, Klassen M, Larsen IL and JL Aalhus. 2012. Canadian beef tenderness survey. Proceedings, 58th International Congress of Meat Science and Technology, ICOMST 2012 paper 191.pdf

all 5 steaks when sampled 0.5 cm from the edge. Indeed, in 2 of the 5 samples from 0.5 cm from the edge, the reduction in *E. coli* was negligible ($\leq$ 0.30 log CFU/g).

In contrast, if the steaks are turned multiple times—at least twice, with a certain turning interval, depending on the thickness of the steak—then cooking to merely 63 ºC (145 ºF) would be enough to eliminate all the *E. coli* O157:H7.[17] As the study concluded, "the findings clearly show that, in some circumstances at least, cooking steaks to 71 ºC and turning over only once could have relatively small effect on *E. coli* O157:H7 at some points in some steaks. The findings also show that turning steaks over more than once during grilling will give greater certainty of adequate heating of all parts of steak than will turning over only once. Moreover, temperature history data indicted that holding steaks after cooking when they are turned over only once during grilling will not reliably compensate for inadequate heating of some parts of the steaks during cooking. *These factors should be taken into account in the formulation of instructions for safe cooking of mechanically tenderized steaks.*"[18] (Italics added.)

These two recently published studies clearly refute the notion that cooking a mechanically tenderized steak to 145 ºF with a three-minute dwell time will be enough to result in a 5.0-log reduction of *E. coli* O157:H7. This is true particularly given the fact that conventional cooking instructions for steaks recommend that they be turned over only once. For steaks turned over only once, the Gill et al. study clearly shows that even cooking to 160 ºF may not be enough "to ensure that potential pathogens are destroyed throughout the product." Thus, we urge FSIS to require that the validated cooking instructions that appear on the label include the instruction that mechanically tenderized steaks should be cooked to a temperature of 160 ºF and turned over at least twice.

Although the Gill et al. study did find that turning over MTB steaks twice during cooking to 145 ºF was enough to lead to a 5.0-log reduction in *E. coli* O157:H7, we do not believe that this single study is enough to allow recommendation of cooking a MTB steak to a temperature lower than 160 ºF, even if turned over twice. More studies should be done to see if the Gill et al. results hold true. Until such studies are done, FSIS should only allow the recommendation to cook mechanically tenderized steaks to an internal temperature of 160 ºF and not lower.

In terms of the recommendation for a rest time, we do not think that this should be allowed for MTB products that are steaks. FSIS says it bases its recommendations for the rest time on a *Salmonella* study published in 1978,[19] which serves as the source of Attachment 2 in FSIS Compliance Guideline for Validated Cooking Instructions for Mechanically Tenderized Beef Product.[20] Attachment 2 of the Guidance is a time/temperature table that results in a 5.0-log reduction in pathogen levels; the table

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[17] See Table 8, pg. 85 in Gill et al. 2013. Op cit.
[18] Pg. 87 in IBID.
[19] Goodfellow and Brown. 1978. Op cit.
[20] FSIS. 2013. FSIS Compliance Guideline for Validated Cooking Instructions for Mechanically Tenderized Beef Product http://www.fsis.usda.gov/wps/wcm/connect/606919b6-5192-40bd-a32b-99a41c75eeb6/Comp_Guide_MTB.pdf?MOD=AJPERES

shows that temperatures as low as 130 ºF with an 86 minute hold time would result in a 5.0-log reduction in *E. coli* O157:H7.

A close reading of the 1978 paper, however, shows that the experiment was done by inoculating ground beef with *Salmonella*, then putting that beef in tubes, and then putting the tubes into a water bath heated to temperatures of 125, 135 and 145 ºF. Thus, the "rest times" that appear in Attachment 2 of the Guidance are for "rest times" at a given temperature. So, a recommendation to cook an MTB product to 145 ºF and let it rest for three minutes would be based on an assumption that the MTB product would be resting at a surrounding temperature held at 145 ºF, and not at room temperature.

For larger cuts of beef, e.g. roasts, whole tenderloins, stew or shank cross cuts, or short ribs, one could argue that it might be the case, that they could be held in an oven that has been turned off but still retains heat,/or that the large size and smaller surface-area-to-volume ratio of such beef cuts, compared to thin steaks, means that there would be enough internal heat to continue cooking the meat. But for MTB steaks this clearly will *not* be the case.

Thus, we urge FSIS to not allow a recommended rest time for mechanically tenderized steaks to serve as a safety instruction. And for larger MTB products, e.g. roasts, whole tenderloins, stew or shank cross cuts, or short ribs, USDA should only allow rest times if there are data to support their effectiveness. In the absence of such data, no temperature below 160 ºF should be allowed for any MTB product**.**

We agree with FSIS' proposal to "conduct a public education campaign to explain the significance of the term "mechanically tenderized" to consumers," and we urge FSIS to include the recommendation that mechanically tenderized steaks should be turned over at least twice as part of this campaign.

In terms of the recommended endpoint cooking temperature, given the conclusions of the studies cited above, the importance of providing consumers with accurate and easy-to-follow recommendations, and the fact that it is the recommended endpoint cooking temperature for ground beef, CU believes that an endpoint temperature of 160 ºF is the most protective of public health. Consequently, we urge FSIS to recommend that MTB products be cooked to 160 ºF and that steaks should be turned over at least twice during cooking.

We agree with FSIS that the validated cooking instructions on the label should state that a thermometer should be used to measure the internal temperature.

FSIS Compliance Guidance Should be Updated

FSIS refers to the Compliance Guidance as "drawing heavily on the findings of two recent ARS [Agricultural Research Service] studies (Luchansky 2011,[21] Luchansky 2012[22])." While we commend FSIS for using these two studies in advising establishments on identifying the minimum components of validated cooking instructions, we believe FSIS has made incorrect use of the Attachment 2 Guidance. As pointed out previously, the 1978 study which forms the basis for Attachment 2 involved inoculating ground beef with *Salmonella*, putting that beef in tubes, and then putting the tubes into a water bath heated to temperatures of 125, 135 and 145 ºF. Thus, the column in Attachment 2 labeled "Time for 5.0-log reduction" refers to how long the meat has to be held at a given temperature to achieve the 5.0-log reduction. Given that most MTB products, but especially steaks, would be "rested" at room temperature, we do not believe that Attachment 2 can be a reliable guide. We urge FSIS to either remove Attachment 2 or explain why it would still be valid to be used. We also note that the Guidance does not include the two studies published in 2013; we believe the Guidance should be updated to include information from these studies.[23]

Respectfully submitted,

Michael Hansen, Ph.D.
Senior Scientist

[21] Luchansky JB, Porto-Frett ACS, Shoyer BA, Call JE, Schlosser W, Shaw W, Bauer N and H Latimer. 2011. Inactivation of Shiga toxin-producing O157:H7 and non-O157:H7 *Escherichia coli* in brine-injected, gas-grilled steaks. *Journal of Food Protection*, 74: 1054-1064.

[22] Luchansky JB, Porto-Frett ACS, Shoyer BA, Call JE, Schlosser W, Shaw W, Bauer N and H Latimer. 2012. Fate of Shiga toxin-producing O157:H7 and non-O157:H7 *Escherichia coli* cells within blade-tenderized beef steaks after cooking on a commercial open-flame gas grill. *Journal of Food Protection*, 75: 62-70.

[23] Luchansky et al. 2013. Op cit.; Gill et al. 2013. Op cit.