Critical Limit Summary for Turkey Jerky Process Lethality

This summary explains validated processes for the manufacture of whole-muscle turkey jerky or other whole-muscle poultry jerky, e.g. chicken jerky.

**Background:** Processing whole-muscle turkey into jerky is intended to make a dry product with desirable texture and shelf-stability. However, pathogen destruction is more rapid in a moist-heat environment than in a dry-heat environment. In a dry-heat environment, evaporative cooling on the surface can keep a meat strip from getting hot enough to kill bacteria, and dry-heat early in the process stage may make pathogens heat-resistant so that they survive the later stages of the process.

Alternate Appendix A Process based on USDA-FSIS 2014 Compliance Guideline. The USDA-FSIS issued a Compliance Guideline for Meat and Poultry Jerky Produced by Small and Very Small Establishments (2014). This Compliance document allows processors to use less than the 90% humidity otherwise required in Appendix A if relative humidity/wet-bulb temperature is maintained for a sufficient period of time: Establishments have the flexibility to use the options in Appendix A that utilize less than 90% relative humidity; that is, the options of: Heating roasts of any size to a minimum internal temperature of 145°F (62.8°C) in an oven maintained at any temperature if the relative humidity of the oven is maintained **either by continuously introducing steam for 50 percent of the cooking time or by use of a sealed oven for over 50 percent of the cooking time**, or if the relative humidity of the oven is maintained at 90 percent or above for at least 25 percent of the total cooking time, but in no case less than 1 hour. The 2012 Compliance Guidelines further state: The literature review has shown that **at least 27-32% relative humidity should** be present during the cooking process to ensure that adequate lethality is attained. In addition, the wet bulb temperature should reach at **least 125-130°F for an hour** or more during the lethality process (Buege, 2006a; Harper, 2009).

**Alternative Appendix A process:**

1) Maintain the relative humidity of the ovens at least 27-32% for at least 50% of lethality step by **continuously introducing steam or by use of a sealed oven**; this time to be **at least 1 hour**, OR
   Maintain the relative humidity of the ovens of at least 90% for at least 25% of lethality step (humidity maintained with a sealed oven or by continuously introducing steam); this time must be **at least 1 hour**, …**AND**

2) During the lethality stage, achieve a **product internal temperature/time combination** of at least 145°F for at least 4 minutes **and** maintain a wet bulb setting of 125-130°F for at least 1 hour.

Once lethality is met, the product is dried to achieve shelf stability. As an example, for a standard smokehouse/oven schedule operating with the oven (dry-bulb) temperature set at 165°F, critical limits would be as follows:

**CCP1:** Cooking (lethality)

Critical limits (must be monitored):
- Oven temperature setting 165°F.
- Relative humidity at least 27% for at least 1 hour.
- Wet bulb temperature at least 121°F for at least 1 hour.
- Product internal temperature at least 145°F for at least 4 minutes.

**CCP2:** Drying (shelf stability)

Critical limits (must be monitored):
- Oven temperature setting 165°F.
- Dry to water activity of 0.85 or lower (to achieve shelf stability).

A document which describes how a processor might correlate yield and water activity can be found here: [http://www.meathaccp.wisc.edu/prerequisite_programs/assets/SOP%20Packaging.pdf](http://www.meathaccp.wisc.edu/prerequisite_programs/assets/SOP%20Packaging.pdf)

See below for additional validated processes.
Additional validated processes based on published research. Researchers at the USDA’s Eastern Regional Research Center (ERRC), in collaboration with the University of Wisconsin-Madison, have studied two alternative processes for making whole-muscle turkey jerky that have enough lethality. The results of these studies have been published in a peer-reviewed scientific journal article and are considered validated processes for the manufacture of whole muscle poultry jerky; a summary follows. The Critical Limits for each of the processes summarized below are the smokehouse temperatures (dry-bulb and/or wet-bulb), process times and % RH values. Supporting research documentation can be found at the end of this document.

Research Results: The USDA Compliance Guidelines for Meat and Poultry Jerky issued in 2012 indicated that the lethality treatment for poultry jerky must achieve at least a 7-log reduction of Salmonella spp.; a 3-log reduction of L. monocytogenes is also required. A lethality of 7-logs was achieved for each pathogen in marinated and non-marinated strips processed at a dry-bulb temperature of at least 165°F for at least 3.5 h, or at a dry-bulb temperature of at least 180°F for at least 2.5 h. The initial Relative Humidity was at least 49% for both processes; the final Relative Humidity was at least 30% for 165°F processes and at least 24% for 180°F processes.

Note, your critical limits do not include dampers being opened or closed, nor do they list the continuous injection of steam into the oven, these steps should be described in an SOP for Oven/Smokehouse Operation. The Guidelines do require that humidity is achieved by either introducing steam or closing the dampers.

Process 1 (Smokehouse Settings):

<table>
<thead>
<tr>
<th>CCP</th>
<th>Dry-Bulb (°F) (oven must reach 165°F within 30 minutes)</th>
<th>Wet Bulb (°F) (When 165°F dry bulb recorded. Must be at least 124°F (30% RH) after 3.5 hours)</th>
<th>Time for this stage (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking / Lethality</td>
<td>165°F</td>
<td>139°F (49% RH)</td>
<td>210 minutes (3.5 hours)</td>
</tr>
<tr>
<td>Drying</td>
<td>Any</td>
<td>NA</td>
<td>Until dryness (a_w 0.85 or below)</td>
</tr>
</tbody>
</table>

Process 2 (Smokehouse Settings):

<table>
<thead>
<tr>
<th>CCP</th>
<th>Dry-Bulb (°F) (oven must reach 180°F within 30 minutes)</th>
<th>Wet Bulb (°F) (When 180°F dry bulb recorded. Must be at least 130°F (24% RH) after 2.5 hours)</th>
<th>Time for this stage (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking / Lethality</td>
<td>180°F</td>
<td>153°F (49% RH)</td>
<td>150 minutes (2.5 hours)</td>
</tr>
<tr>
<td>Drying</td>
<td>Any</td>
<td>NA</td>
<td>Until dryness (a_w 0.85 or below)</td>
</tr>
</tbody>
</table>


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