

HACCP



JERKY HACCP GUIDANCE

This guidance is for food service operators who want to commercially prepare dried jerky products and do not already have an approved Hazard Analysis Critical Control Point (HACCP) plan.

For Retail Operators
Rev 2.0-5/23

Carson City Health & Human Services
Environmental Health Division

900 E Long St.
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Tel: (775) 887-2190
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Retail Jerky Guidance for Food Service

Background Information

Meat or poultry jerky is a ready-to-eat (RTE), dried product that is generally shelf-stable (i.e., it does not require refrigeration after proper processing) Pathogenic bacteria can survive drying processes if controls are not properly implemented.

In 2003, an outbreak of salmonella sickened at least 22 people. The outbreak was traced to jerky made at a facility in New Mexico. The facility dried the jerky to a crumbling state in an oven set at 180°F. The facility was located at a relatively high altitude with low humidity. This caused evaporative cooling as the meat slowly dried. Evaporative cooling reduces the temperature that the bacteria are actually subjected to. A wet bulb thermometer measured only 86°F in these same ovens. Wet bulb temperatures are a more accurate representation of the actual meat temperature. In this instance, *Salmonella bacteria* were able to shed moisture during the slow drying and become very resistant to the dry heat.

This outbreak illustrated the need for humidity during the beginning of jerky processing in order to sufficiently reduce the number of pathogenic bacteria. Without sufficient humidity the product surface may dry too quickly, and the bacteria may become more heat resistant. Carefully monitoring humidity is especially important for production at altitudes between 3,000 to 7,000 feet or areas of low humidity. Establishments located at higher altitudes will generally have a lower atmospheric pressure. This lower pressure leads to lower boiling points and faster evaporation from the product surface. (*Carson City, NV is approximately 4,802 feet above sea level; Lake Tahoe is approximately 6224 feet above sea level*)

Note: Evaporative cooling on the surface of the meat strips can keep them from getting hot enough to kill dangerous bacteria. Dry conditions during the early stages of the heating process may make the pathogens more heat-resistant so that they survive the later stages of the process. Humidity during the initial heating period can help prevent evaporative cooling and ensure adequate pathogen reduction.

How to Obtain a Waiver to Manufacture Jerky

A food service establishment must have a plan approved by the health department before they can manufacture jerky. The plan must identify basic food safety practices such as time and temperature monitoring, adequate humidity and water activity.

Your establishment must be in good standing and demonstrate control of food safety risk factors in order to qualify for a waiver approval.

1. A waiver request application form must be completed and submitted to your local health inspector for review and approval.
2. If you do not already have a written HACCP plan fully developed to submit with the waiver, a supplemental form may be completed and submitted to help you document the necessary information. This supplemental information completed in detail may be sufficient to function as your HACCP plan for some processes; however some more complex processes may require full HACCP plans which may need to be reviewed and approved by a process authority.
3. Employees must be properly trained on your process. Training procedures should be included with your submission.
4. All critical control points in your process (CCP's) will require record keeping. Copies of the logs you will use should be included in your submission.

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Supplemental Jerky HACCP Information

- There is a Supplemental Jerky HACCP Information Form available to assist you with developing your food safety plan. Jerky processes must be supported by **validated** methods from **credible** sources.
- Establishments seeking to produce jerky should provide scientific evidence that supports the safety of their process. **University extension services can be a valuable tool for obtaining such information.**
- The University of Wisconsin Madison provides several meat HACCP tools including Critical Limit Summaries for Validated Jerky Processes
 - https://meathaccp.wisc.edu/validation/heat_treatment.html
 - https://meathaccp.wisc.edu/Model_Haccp_Plans/heat_treated_shelf_stable.html
- Facilities submitting processes that do not follow existing validated methods may work with a process authority and/or conduct challenge studies to verify adequate pathogen reduction.

Wholesale Restrictions on Meat Products:

Most meat products can only be sold wholesale if manufactured in a USDA inspected facility. Only direct sales are allowed for jerky made in a regular retail facility. If you would like to wholesale your jerky product (sell to other stores or markets), you will need to contact a USDA inspected facility and see if they are willing to manufacture your product for you. Alternatively you may contact the USDA for more information on creating your own USDA inspected facility.

Special Requirements for Manufacturing Jerky

The manufacturer must apply a treatment to control, or reduce, the biological hazards.

A time-temperature lethality table is provided in this document as guidance, however these time and temperature guidelines are based off of **“wet heat”**, consequently humidity criteria must be closely followed during the cooking/heating (lethality) step. Without humidity, the product will dry, and the bacteria will become more heat resistant. It is important that the processor prevent drying of the product until a lethal time-temperature combination is reached.

It's also important to note that the lethality table is based off of **“internal”** product temperatures which can be difficult to monitor in thin jerky slices. One slice of jerky can be cut twice as thick as the other slices for the purposes of monitoring internal temperature.



Humidity during heating is a critical factor

Wet heat can be rapidly achieved during a lethality process that heats the product to $\geq 160^{\circ}\text{F}$ in a liquid such as marinade, brine, or water. These liquid methods are highly recommended for small manufacturers because it is much easier than monitoring oven humidity levels; however studies have shown that such methods may not achieve desirable quality results for all jerky product types. (Flavor or texture may be impacted for some recipes)

Humidity and temperature requirements cannot be maintained using household style dehydrators, such units may or may not be adequate for subsequent drying steps, but are typically insufficient to provide the lethality necessary for commercial jerky production. Any proposed process utilizing dehydrators would need to incorporate additional validated control measures.

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More commonly, lethality processes are conducted in ovens or smoke houses which should be monitored for humidity using either a humidity sensor or by using wet and dry bulb thermometers to determine the relative humidity. Humidity calculators are available online to help establishment determine the relative humidity based on dry and wet bulb readings. (Example www.ringbell.co.uk/info/humid.htm)

If the lethality step is less than 1 hour,

- Establishments may follow established time temperature combinations provided in the lethality chart at the end of this document.
- A relative humidity of 90% must be maintained throughout the entire lethality step.
- When trying to maintain 90% relative humidity, wet and dry bulb temperatures should not differ by more than 4.5°F. A temperature difference greater than 4.5°F indicates a relative humidity of approximately 86% and shows that the minimum relative humidity (90%) is not being maintained at the correct level.

For processes with lethality steps of at least an hour,

- Establishments may follow established validated processes with time, temperature and humidity levels that have been demonstrated to achieve a sufficient pathogen reduction **so long as the oven remains sealed and/or steam is introduced for at least an hour.**
- For example the following method was validated at the University of Wisconsin (Buege and others 2006) and further validated in an additional study conducted at Utah State University. (Allen K. and others 2007)
 1. *A dry bulb oven temperature of 170°F with a wet bulb temperature of at least 130°F (relative humidity ≥ 32) maintained for at least 1 hour.*
 2. *Followed by drying until water activity is < 0.85 . Drying temp should be at least 130°F (dry bulb)*
- It is important to note that “lower temperature longer time” methods will require higher humidity and even when high humidity is maintained; such processes may not achieve sufficient pathogen reduction especially in high altitude low humidity environments. Additional intervention steps or post drying heat treatment may be used to supplement such a process.

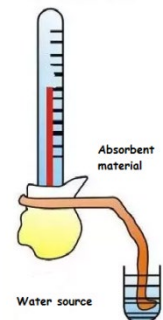
Here are some simple and practical steps to achieving adequate humidity:

Seal the oven

- Close the oven dampers to provide a closed system and prevent moisture loss. (Steam may still be seen venting when the dampers are closed)

Add humidity

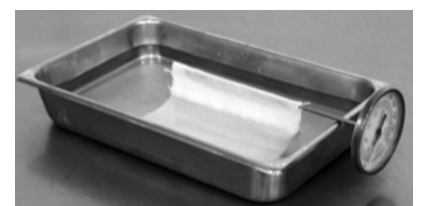
- Place a wide, shallow pan of **hot water** in the oven to provide humidity in the system.
- Injecting steam or a fine water mist in the oven can also add humidity.
- Conduct a test run to determine whether the desired humidity is achieved.



Making your own wet bulb

- A wet bulb thermometer is a thermometer covered in water-soaked cloth. Air must be able to pass over the damp cloth. Water will constantly evaporating from the wetted material and cool the thermometer. The end of the cloth must be submerged in water so that moisture can wick up the cloth and prevent it from fully drying out. The cloth material is often referred to as the wet bulb sock.
- Wet bulbs socks can be purchased online, but they can also be easily made.
- A wet bulb can be constructed by wrapping a wet 100% cotton cloth around an oven thermometer. The following link describes a method for making a wet bulb thermometer using a cotton shoe lace wrapped around the thermometer tip secured using a piece of tape.

https://meathaccp.wisc.edu/assets/wet_bulb.pdf



Retail Jerky Guidance for Food Service

Drying and Optional Jerky Processing Steps

Interventions

Many jerky processes incorporate antimicrobial intervention strategies such as the addition of curing ingredients or the use of antimicrobial dips such as acetic acid or calcium sulfate solutions. Some heating processes may not deliver an adequate lethality and, thus, may require an additional intervention step to ensure product safety. When adding restricted curing ingredients, it is critical that all ingredients are carefully measured to ensure that safe concentration levels are achieved. Weight records must be maintained for such recipes to document the measuring process.

Surface preparation

Many jerky processes incorporate a surface prep heat step prior to the addition of humidity. Strips are heated using a low temperature heat step which makes the surface tacky to aid in smoke adherence and improve product texture. Humidity is often not introduced until the next step, the lethality treatment. The lack of humidity during the initial surface preparation step is generally not a food safety concern because the step is usually too short (30 minutes or less) to dry out the product.

Drying

It is important that a temperature of at least 130°F is maintained during the drying process so that drying will occur fast enough to prevent spoilage. Drying times must be sufficient to achieve a water active of <0.85 to ensure shelf stability and prevent the growth of toxin forming staph bacteria.

Post-drying heat step

A post-drying heat step may be added to increase the level of pathogen reduction beyond that achieved by heating alone. When employing high risk lethality methods such as lower temperature longer time processes, this step may be needed to ensure an adequate reduction of *Salmonella*. The following post-drying heat step has been validated to reduce *Salmonella* levels by approximately 2-logs: *Heating the already dried product in a 275°F oven for 10 minutes* (Harrison et al., 2001).

Water activity determination

In order to achieve a shelf-stable product, a water activity critical limit of 0.85 or lower should be targeted for shelf stability. This water activity limit is necessary to prevent the growth of toxin forming staph bacteria. Ideally a water activity meter should be used to determine the final water activity level of each batch. If an establishment is unable to purchase and maintain a water activity meter, they may choose to work with a certified laboratory to evaluate multiple samples from at least three different batches of product in order to correlate product yield to water activity. Slices would be weighed before and after drying and then sent to a laboratory where they would be analysed for moisture, protein and water activity. The lab may then help the manufacturer determine the maximum yield that would ensure a water activity below 0.85.

Special Processes Requiring a Full HACCP Plan & Process Authority

The Carson City and Douglas County Public Health Regional Partnership reserves the right to require full HACCP and process authority review for any process when they deem is necessary. Contact info for several process authorities is available at: <http://www.afdo.org/foodprocessing>.



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Jerky HACCP Supplemental Information Form

Any alterations, modifications or changes to an approved HACCP, must be resubmitted for review and approval of the Environmental Health Division.

This form is applicable for whole muscle and ground-and-formed jerky manufactured in very small facilities. Carefully monitored processes are necessary to control pathogenic bacteria that may survive drying processes, particularly Salmonella and E. coli O157:H7.

General Information		
Name of Owner & Title:	Phone:	
Establishment Name:	Email:	
Mailing Address:	City:	Zip Code:
HACCP TEAM Members		
Name	Title / Role	
1) List jerky equipment to be used (such as oven, thermometers, etc.) Or attach manufacturer's specification sheets. Record NA if not applicable.		
Oven / Smokehouse		
Dehydrators		
Thermometers		
Wet bulb thermometer or hydrometer		
Refrigerators		
Water activity meter		
Scale		
Other		



Jerky HACCP Supplemental Information Form

Definitions

Control Points in the jerky process are the steps in the flow of food from receiving to service.

Critical Control Points are steps that, when done correctly, can control the possibility of a food borne illness outbreak. An example might include maintaining a high enough wet bulb temperature for at least an hour when cooking beef jerky in a sealed oven.

Typically lethality times, temperatures, and humidity are the jerky CCPs. Intervention such as measuring curing ingredients may also be a CCP.

Critical Limits are the maximum or minimum value to which physical, biological or chemical parameters must be controlled at a CCP to minimize the risk of a foodborne illness outbreak. An example might be maintaining a wet bulb temperature of at least 130°F when cooking beef jerky in a sealed oven.

Corrective Actions are what is done to correct a step that's gone out of control. An example would be to continue to add additional humidity to the oven if the wet bulb temperature dropped below 130°F and possibly adding a post drying heat step to help compensate for the deficiency.

Process Flow Instructions

- Examine the example process flow provided at the end of this document. Make one copy of the example process flow diagram for each jerky product type you make. For example, if you make both whole muscle and ground and formed jerky types, you will need a flow diagram for each type.
- Use a highlighter or other pen to show the actual process flow you use for each product. Cross out any steps you don't use. Mark directional arrows as necessary to make the process clear.
- List all of your preparation steps (combining ingredients/processing). Such steps may include, marinating, acidic dips, curing agents, etc.
- Add any other processing steps not already shown
- Once you have determined your flow steps, you should be able to draw out your process flow



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Jerky HACCP Supplemental Information Form

3) Process flow

- A) Describe your process for preparing each jerky type or recipe type.
Create a simple flow diagram from ingredient receiving to service
(Additional flows may be attached if needed for multiple processes or recipes)



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4) Process steps and critical control points

Is any restricted cure ingredient used? (i.e. Nitrites)

If yes, provide details as to how safe levels are ensured. When careful weights must be taken, provide details as to how those measurements will be taken, by whom, and what records will be maintained.

Describe your marinating process. Will a fresh batch of marinade be used for each batch?

Will any intervention steps be applied such as dipping strips of jerky in an acetic acid or in a calcium sulfate solution before or after marinating to help inhibit bacterial growth? If so, provide the product details and concentrations used.



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4) Process steps and critical control points - continued

Describe your lethality process. Include all critical limits for time, temperature, and **humidity** parameters. Include oven temperature settings (Dry Bulb Temp) and Wet bulb temperature requirements.

How will you maintain adequate humidity to prevent evaporative cooling during the lethality step?



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4) Process steps and critical control points - continued

How will you monitor humidity? Describe wet bulb if used.
(If making your own wet bulb 100% cotton is recommended)

Who takes the temperature / humidity readings and how often?

What corrective action is taken if critical limits for time temperature and humidity are not achieved?



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4) Process steps and critical control points - continued

Describe your drying process. Include all time and temperature parameters

Who takes the time & temperature readings and how often?

Water Activity Determination

How will the water activity be determined to verify that each batch is shelf stable? (<0.85)

A water activity below 0.85 is necessary to control toxin forming staph bacteria. Will you be purchasing a water activity meter, or will you be conducting a study through an accredited laboratory in order to relate yield to water activity?

What corrective action is taken if the necessary water activity level is not achieved?



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Jerky HACCP Supplemental Information Form

5) Records: Attach copies of all logs to be used for record keeping

There must be a log for each CCP

Who verifies that records for lethality and drying are properly maintained? How often do they review the records?

Where will your lethality and dry records be kept and for how long?

6) Packaging & Labeling

Describe how the product will be packaged and labeled



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7) Describe or attach operational procedures for the following subjects

Identify a designated work for jerky processing and describe the methods that will be used to prevent cross contamination (A picture may be attached for reference if desired)

Describe how jerky processes and equipment will be limited to responsible trained personnel who understand the risk involved

Describe your procedures regarding operator hygiene and prohibiting bare hand contact with ready- to-eat foods



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7) Describe or attach operational procedures for the following subjects - continued

Describe your cleaning and sanitizing procedures for food contact surfaces

Describe or attach your training program that ensures that staff involved in the jerky operation understand the concepts required for a safe operation

Describe or attach any additional information relevant to your process as needed



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Jerky HACCP Supplemental Information Form

All jerky waiver applications must be submitted to your health inspector for review and approval prior to manufacturing jerky in your establishment. Applications will be denied if the inspector believes the proposed HACCP plan does not take the proper precautions to keep the public from harm.

By signing and submitting this form to the permit issuing official you are requesting a waiver and establishing a plan to comply with the above requirements as conditions to jerky manufacturing. Failure to implement jerky processing as described is subject to enforcement. Any additions or modifications to this plan must be reviewed and approved by the permit issuing official prior to being implemented.

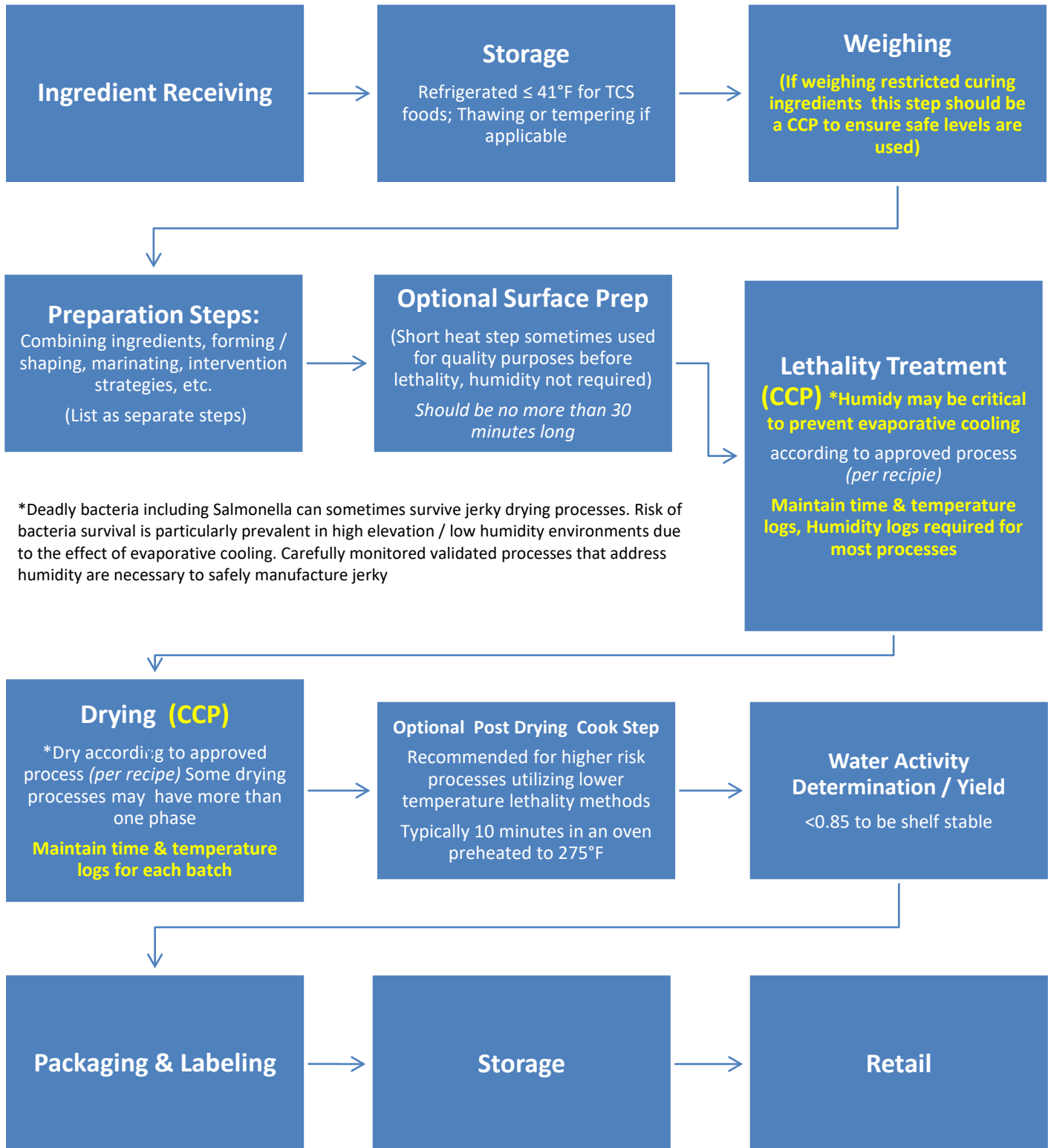
I certify that I have knowledge of the facts herein set forth and that the same are true and correct to the best of my knowledge and belief.

Signature:

Date:

Any alterations, modifications or changes to an approved HACCP, must be resubmitted for review and approval of the Environmental Health Division.

Jerky HACCP Flow Example





Time and Temperature Table

Adapted from **Appendix A** of the FSIS Salmonella Compliance Guidelines for Small and Very Small Meat and Poultry Establishments that Produce Ready-to-Eat (RTE) Products
www.fsis.usda.gov

The following hold times start when the product reaches the internal temperature. Rise times may vary according to the thickness of the product. Temperature monitoring is essential to verifying both time and temperature parameters.

Temperature (°F)	Time for Beef 6.5 log Salmonella Lethality	Time for Chicken (up to 12% fat) 7-log Salmonella Lethality	Time for Turkey (up to 12% fat) 7-log Salmonella Lethality
130	112 min		
131	89 min		
132	71 min		
133	56 min		
134	45 min		
135	36 min		
136	28 min	81.4 min	70.8 min
137	23 min	65.5 min	58.5 min
138	18 min	52.9 min	48.5 min
139	15 min	43 min	40.4 min
140	12 min	35 min	33.7 min
141	9 min	28.7 min	28.2 min
142	8 min	23.5 min	23.7 min
143	6 min	19.3 min	19.8 min
144	5 min	15.9 min	16.6 min
145	4 min	13 min	13.8 min
146	169 sec	10.6 min	11.5 min
147	134 sec	8.6 min	9.4 min
148	107 sec	6.8 min	7.7 min
149	85 sec	5.4 min	6.2 min
150	67 sec	4.2 min	4.9 min
151	54 sec	3.1 min	3.8 min
152	43 sec	2.3 min	2.8 min
153	34 sec	1.6 min	2.1 min
154	27 sec	1.1 min	1.6 min
155	22 sec	54.4 sec	1.3 min
156	17 sec	43 sec	1 min
157	14 sec	34 sec	50.4 sec
158	0 sec	26.9 sec	40.9 sec
159	0 sec	21.3 sec	33.2 sec
160	0 sec	16.9 sec	26.96 sec
161	0 sec	13.3 sec	21.9 sec
162	0 sec	10.5 sec	17.7 sec
163	0 sec	< 10 sec	14.4 sec
164	0 sec	< 10 sec	11.7 sec
165	0 sec	< 10 sec	<10 sec



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REQUEST FOR FOOD ESTABLISHMENT WAIVER

As defined by NAC 446.039, a health hazard or nuisance may not result from the granting of the waiver in the opinion of health authority.

General Information					
Name of Person Requesting Waiver:		Title:		Establishment:	
Phone:		Cell:		Email:	
Street Address:			City:		Zip Code:
Mailing Address:			City, State:		Zip Code:
Type of waiver requested (Check one)					HACCP Food Safety Plan Required?
Smoking food as a method of food preservation rather than as a method of flavor enhancement (NAC 446.183(1)).					YES
Curing food (NAC 446.183(2)).					YES
Using food additives or adding components, including, without limitation, vinegar: (a) As a method of food preservation rather than as a method of flavor enhancement; or (b) To render a food so that it is not potentially hazardous (time/temperature control for food safety) (NAC 446.183(3)).					YES
Packaging food using a reduced oxygen packaging method, except as specified in this chapter, where a barrier to <i>Clostridium botulinum</i> in addition to refrigeration exists (NAC 446.183(4)).					YES
Operating a molluscan shellfish life-support system display tank used to store and display shellfish that are offered for human consumption (NAC 446.183(5)).					YES
Custom processing animals that are for personal use as food and not for sale or service in the food establishment (NAC 446.183(6)).					YES
Preparing food by another method that is determined by the health authority to require a waiver (NAC 446.183(7)), including but not limited to raw animal foods pursuant to NAC 446.164(4)(b).					YES
Sprouting seeds or beans (NAC 446.183(8)).					YES
Other – Rule modification or waiver request for items not involving specialized processes. <i>(Attach additional information)</i>					To Be Determined
Justification:					
* Attach written justification for why you believe the issuing of a waiver will not expose consumers to adverse environmental health conditions; will not create any health hazards; will not create a nuisance; and will protect the health and safety of the public and food service workers.					
Check the applicable types of supporting documents you have attached.					
Operational plans		Scientific study		Monitoring logs	
Labeling/disclaimers		HACCP plan		Written procedures	
				Validation study	
				Other	
<i>I certify that I have knowledge of the facts herein set forth and that the same are true and correct to the best of my knowledge and belief.</i>					
Signature:				Date:	

SECTION BELOW FOR OFFICIAL DEPARTMENT OF HEALTH USE ONLY

Action taken by the Public Health Authority:	
Granted	Denied
<i>Attach reasons for denial or the approval with waiver conditions and effective dates are attached.</i>	
REHS reviewer:	Date:
Manager, EHS:	Date: