USDA

United States Department of Agriculture

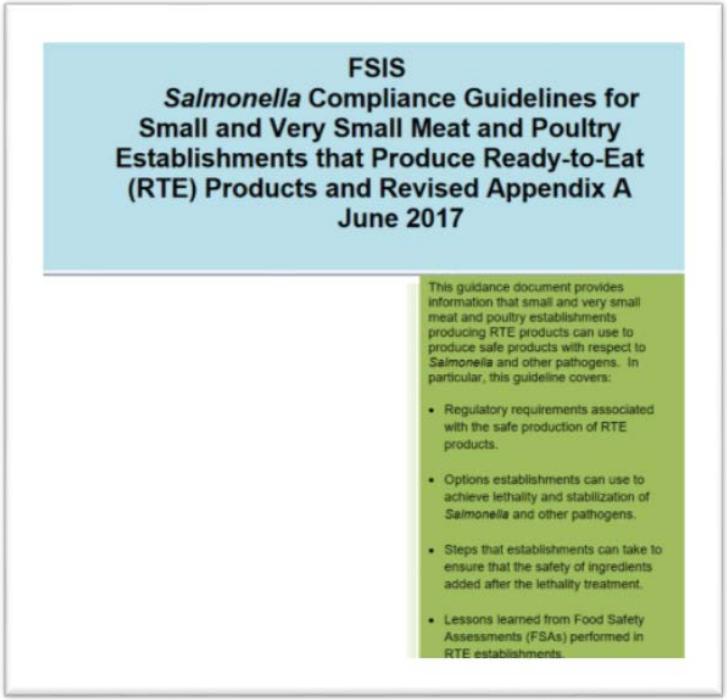
One Team, One Purpose

Food Safety and Inspection Service

Protecting Public Health and Preventing Foodborne Illness

Food Safety and Inspection Service

2017 *Salmonella* Guideline (Appendix A)



IAFP 2018 Annual Meeting
"How to Tell Done is Done: Cooking RTE Foods"

Susan R. Hammons, PhD
Office of Policy and Program Development

Outline

- *Salmonella* in RTE Meat and Poultry Products
  - Sources, Incidence, Lethality
- History:
  - HACCP, Performance Standards, Appendix A
- 2017 FSIS *Salmonella* Guideline/Revised Appendix A
  - Critical Operating Parameters
  - Decision making
- Implementation and Next Steps

Sources of *Salmonella* in Ready-to-Eat Meat and Poultry Products

- **Under processing**
  - Lack of relative humidity (moisture)
  - Under-cooking (time or temperature)
  - Insufficient lethality from multi-hurdle steps (fermentation, drying, antimicrobials, etc.)

- **Cross-contamination** in the post-processing environment.
  - Food contact surfaces contaminated with *Salmonella*,
  - Improper handling by employees,
  - Insect or animal vectors, and
  - Ingredients added after cooking (e.g., herbs, onions, hydrolyzed vegetable protein, or spices)

Products most often positive for *Salmonella*

- FSIS Verification sampling 2010-2016
  - Pork BBQ (7/53)
  - Acidified/Fermented Sausage (7/53)
  - Cooked Sausage (6/53)
  - Jerky/Meat sticks (4/53)
  - Pork Cracklings (3/53)

https://www.flickr.com/photos/jeffreyww/13564142705

What is lethality?

- **Lethality** is the process or combination of processes that ensures a specific, significant reduction in the number of *Salmonella* and other pathogens in the product; as well as reduces other pathogens and their toxins or toxic metabolites.

- Examples of lethality processes:

Cooking

Salt curing

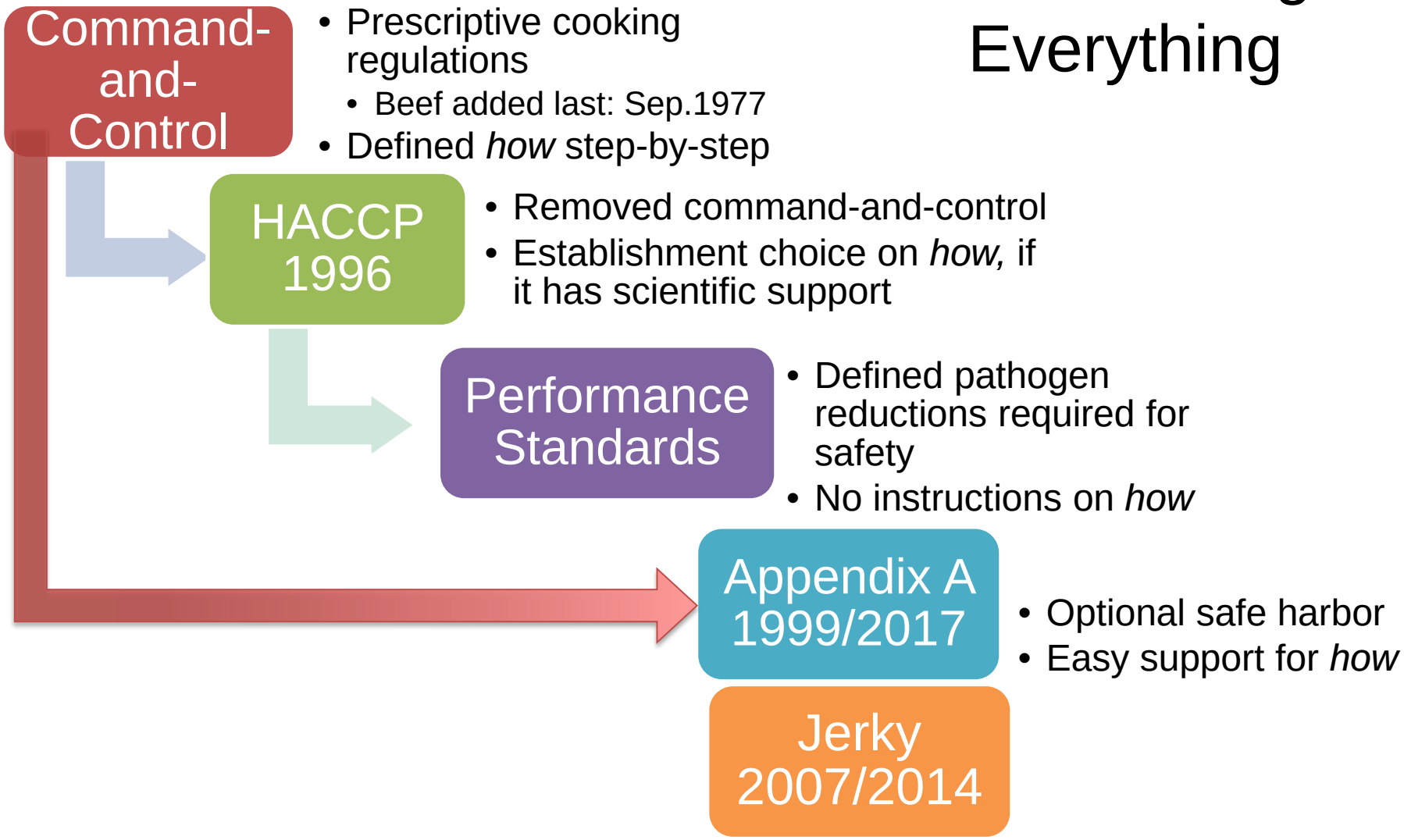
Fermenting

Drying

Consequences of providing regulatory flexibility

HACCP, PERFORMANCE STANDARDS, AND APPENDIX A

HACCP Changed Everything



Regulatory Performance Standards for Certain Cooked Products

- **Roast, cooked, and corned beef** at least a 6.5-log reduction per 9 CFR 318.17(a)(1).*
- **Cooked uncured meat patties** at least a 5.0-log reduction per 9 CFR 318.23
- **Cooked poultry products** at least a 7-log reduction per 9 CFR 381.150(a)(1)*

Performance standards: requirements in terms of what is to be achieved, not the means to achieve those ends.

*or achieve an alternative lethality (see later slides)

Safe Harbor to Achieve the Performance Standards and Recommended Targets

2017 *SALMONELLA* GUIDELINE & REVISED APPENDIX A

2017 *Salmonella* Lethality Guideline

- Combines existing safe harbors & cooking guidance:
  - FSIS Appendix A (1999),
  - Poultry time-temperature tables,
  - 5-log lethality table for meat,
  - Relative humidity guideline (2005)

- New research & guidance on:
  - Evaluating heating deviations
  - Supporting use of the 5-log alternative lethality

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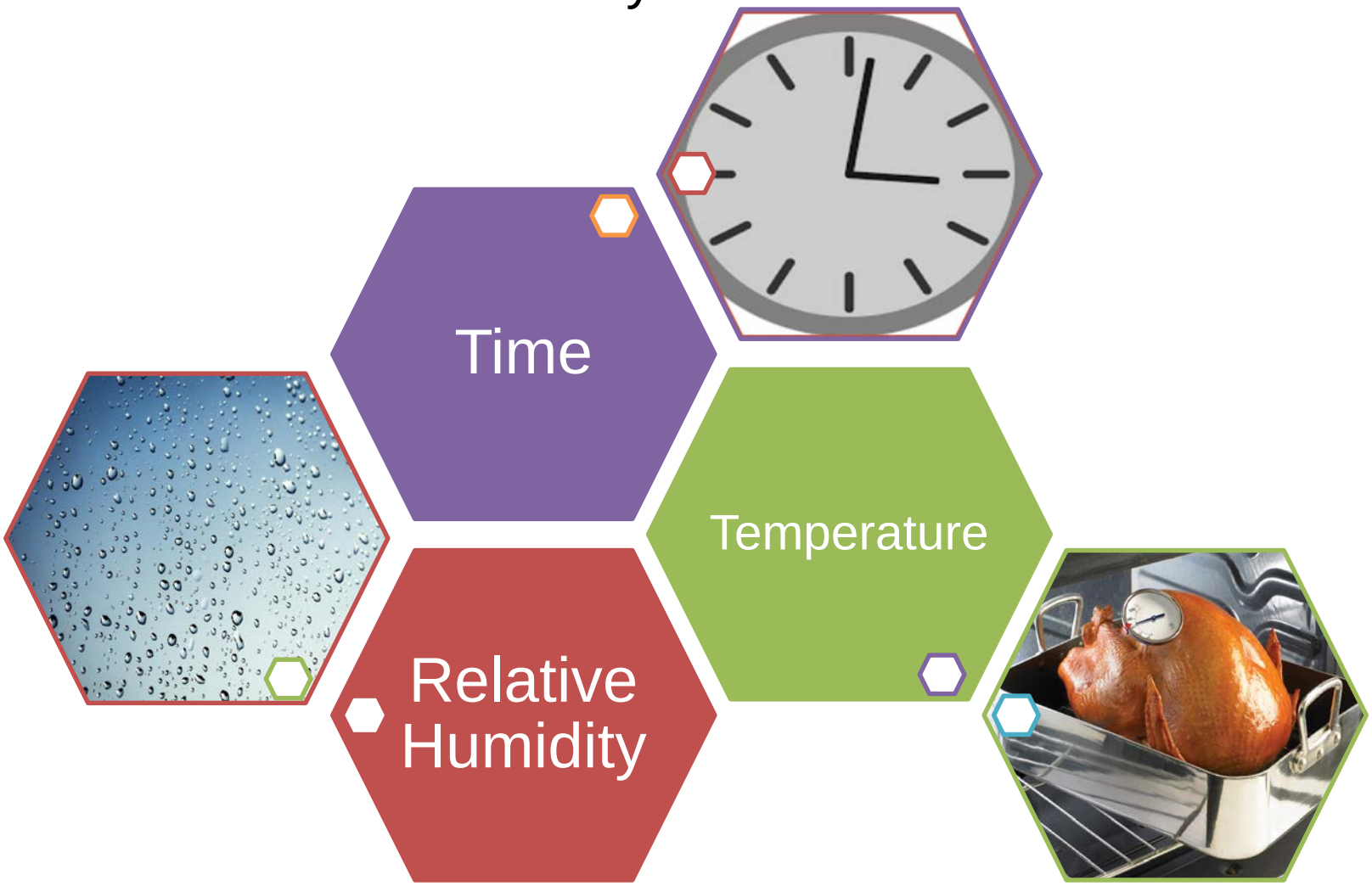
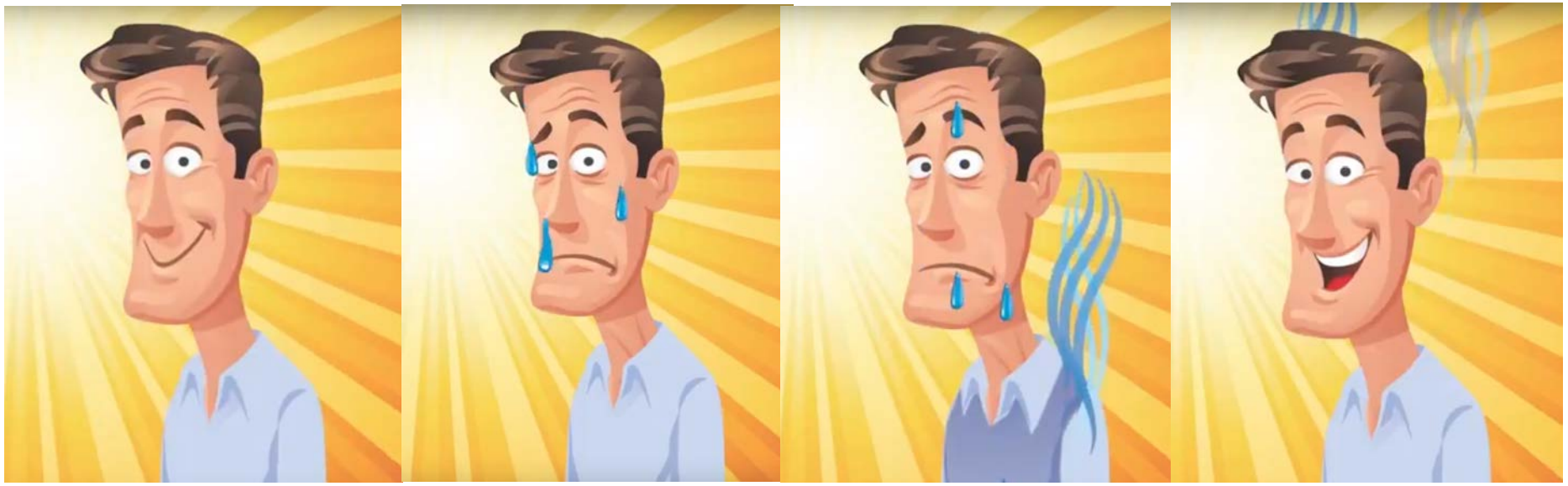
Critical Operating Parameters for Cooking All Meat and Poultry Products





When you get too hot…

you produce sweat…

when that sweat evaporates…

it cools you down.

Evaporation = Cooling

Tropical

VS.

Desert

More Humidity
= Less Cooling

Dry Heat
= Cooling Down

Importance of Moist Heat – Not New

"…it was found that ***Salmonella*** **could survive on the dry roasted beef surfaces** under some circumstances."

Goodfellow, S.J. and W.L. Brown, 1978. Fate of *Salmonella* inoculated into beef for cooking. *J. Food Prot*. 41(8):598-605

"It was postulated that the unexpected **survival** of *Salmonella* inoculated onto the surface of beef rounds was **due to rapid dehydration** of the inoculated organism which in turn resulted in **increased heat resistance**."

Blankenship, L.C., 1978. Survival of a *Salmonella typhimurium* experimental contaminant during cooking of beef roasts. *Applied Environ Microbiol*, 35(6):1160-1165.;

"The **enhancement of heat resistance** by reduced water activity among microorganisms is **well documented**."

1981 – Outbreaks related to cooked beef,

- Time and temperature were good.
- Other procedures (e.g. moist heat) were not addressed.

By 1983 FSIS had codified options for safe cooking of beef

- Continuous Steam Injection
- Sealed Oven
- Cook-in-bag
- 90% Relative Humidity Options

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How to Use the Time Temperature Tables: Appendix A, Poultry Time-Temperature Tables and 5-log Table

1 Select a **time** and **temperature** from one of the tables in this compliance guideline

2 Select a **Relative Humidity (RH)** option

If you selected a time and temperature ≥ 145 °F plus applicable hold time, (eg, 4 minutes from Appendix A) with a cooking time of longer than 1 hour, **select from the following options to maintain Relative Humidity:**

Option 1: Steam Injection for 50% of the cooking time, or 1 hour (whichever is longer)

(RH options continued on pg 32)

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Appendix A

Degrees Fahrenheit	Degrees Centigrade	6.5-log $_{10}$ Lethality	7-log $_{10}$ Lethality
130	54.4	112 min.	121 min.
131	55.0	89 min.	97 min.
132	55.6	71 min.	77 min.
133	56.1	56 min.	62 min.
134	56.7	45 min.	47 min.
135	57.2	36 min.	37 min.
136	57.8	28 min.	32 min.
137	58.4	23 min.	24 min.
138	58.9	18 min.	19 min.
139	59.5	[illegible] min.	15 min.
140	60.0	[illegible] min.	12 min.
141	[illegible]	[illegible] min.	10 min.
142	[illegible]	[illegible] min.	8 min.
143	[illegible]	6 min.	6 min.
144	62.2	5 min.	[illegible]
145	62.8	[illegible]	[illegible]

Meat

5-log Table

FSIS Guidance on Safe Cooking of Non-Intact Meat Chops, Roasts, and Steaks (5-log Table)

Degrees Fahrenheit	Degrees Centigrade	Time for 5.0 log Reduction	Unit Time
130	54.4	86	min.
131	55	69	min.
132	55.6	55	min.
133	56.1	44	min.
134	56.7	35	min.
135	57.2	28	min.
136	57.8	22	min.
137	58.4	18	min.
138	58.9	[illegible]	min.
139	59.5	[illegible]	min.
140	[illegible]	[illegible]	min.
[illegible]	[illegible]	7	min.
142	[illegible]	6	min.
[illegible]	61.7	5	min.
[illegible]	62.2	4	min.
145	62.8	3	min.

Step 1:
Select Time/Temperature

Poultry

Times for given temperature and fat level of Turkey needed to obtain 7-log lethality of *Salmonella**

Degrees Fahrenheit	Degrees Centigrade	1% fat	2% fat	3% fat	4% fat	5% fat	6% fat	7% fat	8% fat	9% fat	10% fat	11% fat	12% fat
136	57.8	64 min	64.3 min	64.6 min	64.9 min	65.3 min	65.8 min	66.3 min	66.9 min	67.6 min	68.4 min	69.5 min	70.8 min
137	58.3	51.9 min	52.2 min	52.4 min	52.8 min	53.2 min	53.6 min	54.1 min	54.7 min	55.3 min	56.2 min	57.2 min	58.5 min
138	58.9	42.2 min	42.5 min	42.7 min	43 min	43.4 min	43.8 min	44.2 min	44.8 min	45.4 min	46.2 min	47.2 min	48.5 min
139	59.4	34.4 min	34.6 min	34.9 min	35.1 min	35.4 min	35.8 min	36.2 min	36.7 min	37.3 min	38.1 min	39.1 min	40.4 min
140	60.0	28.1 min	28.3 min	28.5 min	28.7 min	29 min	29.3 min	29.7 min	30.2 min	30.8 min	31.5 min	32.5 min	33.7 min
141	60.6	23 min	23.2 min	23.3 min	23.5 min	23.8 min	24.1 min	24.4 min	24.9 min	25.5 min	26.2 min	27.1 min	28.2 min
142	61.1	18.9 min	19 min	19.1 min	19.3 min	19.5 min	19.8 min	20.1 min	20.5 min	21.1 min	21.7 min	22.6 min	23.7 min
143	61.7	15.5 min	15.6 min	15.7 min	15.9 min	16.1 min	16.3 min	16.6 min	17 min	17.4 min	18 min	18.8 min	19.8 min
144	62.2	12.8 min	12.8 min	12.9 min	13 min	13.2 min	13.4 min	13.7 min	14 min	14.4 min	15 min	15.7 min	16.6 min
145	62.8	10.5 min	10.6 min	10.6 min	10.7 min	10.8 min	11 min	11.3 min	11.5 min	11.9min	12.4 min	13 min	13.8 min
146	63.3	8.7 min	8.7 min	8.7 min	8.8 min	8.9 min	9 min	9.2 min	9.5 min	9.8 min	10.2 min	10.8 min	11.5 min
147	63.9	7.1 min	7.1 min	7.1 min	7.2 min	7.3 min	7.4 min	7.5 min	7.7 min	8 min	8.4 min	8.8 min	9.4 min

Times for given temperature and fat level for Chicken needed to obtain 7-log lethality of *Salmonella**

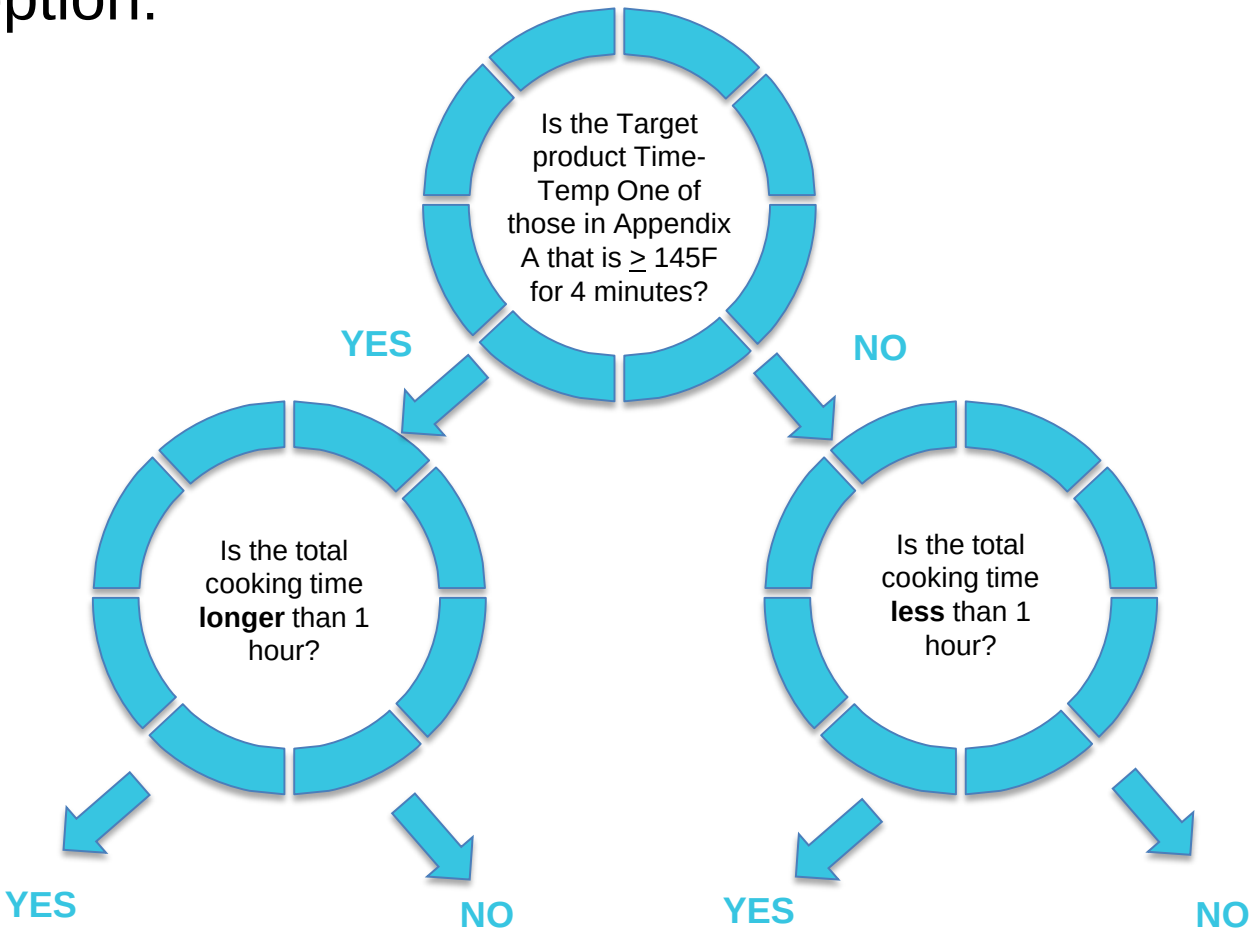
Degrees Fahrenheit	Degrees Centigrade	1% fat	2% fat	3% fat	4% fat	5% fat	6% fat	7% fat	8% fat	9% fat	10% fat	11% fat	12% fat
136	57.8	63.3 min	64.5 min	65.7 min	67 min	68.4 min	69.9 min	71.4 min	73 min	74.8 min	76.7 min	78.9 min	81.4 min
137	58.3	50.1 min	51 min	52.1 min	53.2 min	54.3 min	55.5 min	56.8 min	58.2 min	59.7 min	61.4 min	63.3 min	65.5 min
138	58.9	39.7 min	40.5 min	41.3 min	42.2 min	43.2 min	44.2 min	45.3 min	46.4 min	47.7 min	49.2 min	50.9 min	52.9 min
139	59.4	31.6 min	32.2 min	32.9 min	33.6 min	34.4 min	35.2 min	36.2 min	37.2 min	38.3 min	39.6 min	41.1 min	43 min
140	60.0	25.2 min	25.7 min	26.2 min	26.8 min	27.5 min	28.2 min	29 min	29.8 min	30.8 min	32 min	33.4 min	35 min
141	60.6	20.1 min	20.5 min	21 min	21.5 min	22 min	22.6 min	23.2 min	24 min	24.9 min	25.9 min	27.1 min	28.7 min
142	61.1	16.1 min	16.4 min	16.8 min	17.2 min	17.6 min	18.1 min	18.7 min	19.4 min	20.1 min	21 min	22.1 min	23.5 min

Step 2: Support Relative Humidity

- Choose an option based on internal temperature and total cook time
  - Steam Injection (≥1 hour, ½ time)
  - Sealed oven (≥1 hour, ½ time)
  - 90% RH (≥1 hour, ½ time)*
  - 90% RH entire cooking time (if < 1 hour)

*Products cooked for >4 hours may support 90% RH for ¼ cooking time (no less than 1 hour).

Example procedure for selecting a relative humidity option:



Is the Target product Time-Temp One of those in Appendix A that is ≥ 145F for 4 minutes?

YES

YES

Is the total cooking time **longer** than 1 hour?

Choice of:

- Steam injection for a least 1 hour or more**
- Sealed oven for at least 1 hour or more**
- At least 90% RH for at least 1 hour or more**

** For processes with cooking times > 2 hours, RH (introduced by steam injection, sealed oven, or at > 90%) should continue to be maintained for at least 50% of the cooking time which would result in more than one hour.

Is the Target product Time-Temp One of those in Appendix A that is ≥ 145F for 4 minutes?

YES

NO

Is the total cooking time **longer** than 1 hour?

At least 90% RH for entire cooking time

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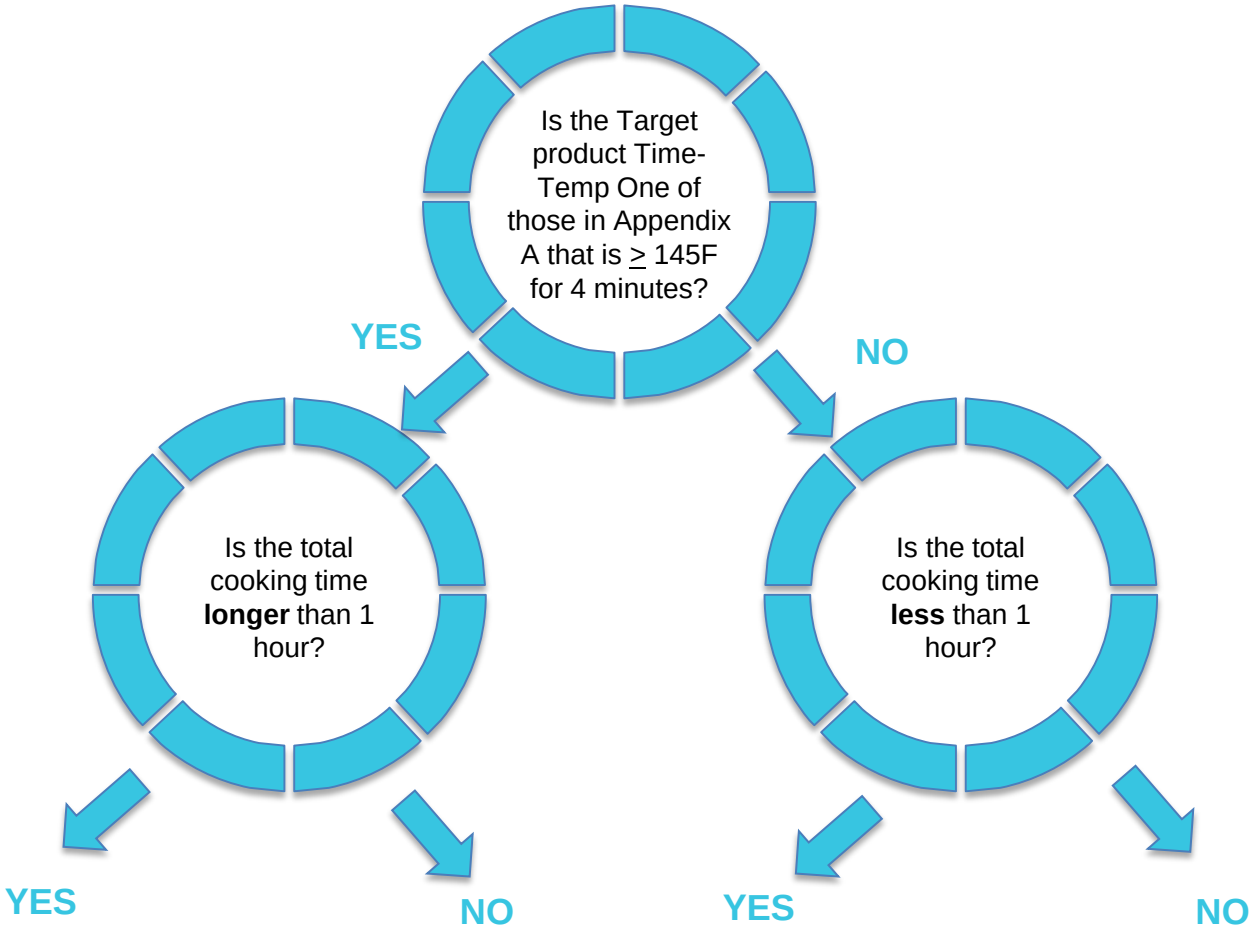
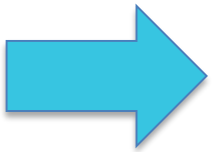


Is the Target product Time-Temp One of those in Appendix A that is ≥ 145F for 4 minutes?

NO

Yes

Is the total cooking time **less** than 1 hour?



At least 90% RH for entire cooking time

Is the Target product Time-Temp One of those in Appendix A that is ≥ 145F for 4 minutes?

NO

NO

Is the total cooking time **less** than 1 hour?

At least 90% RH for at least 1 hour or more*

* For processes with times >4 hours, RH should be 90% for at least 25% of cooking time which would result in more that one hour

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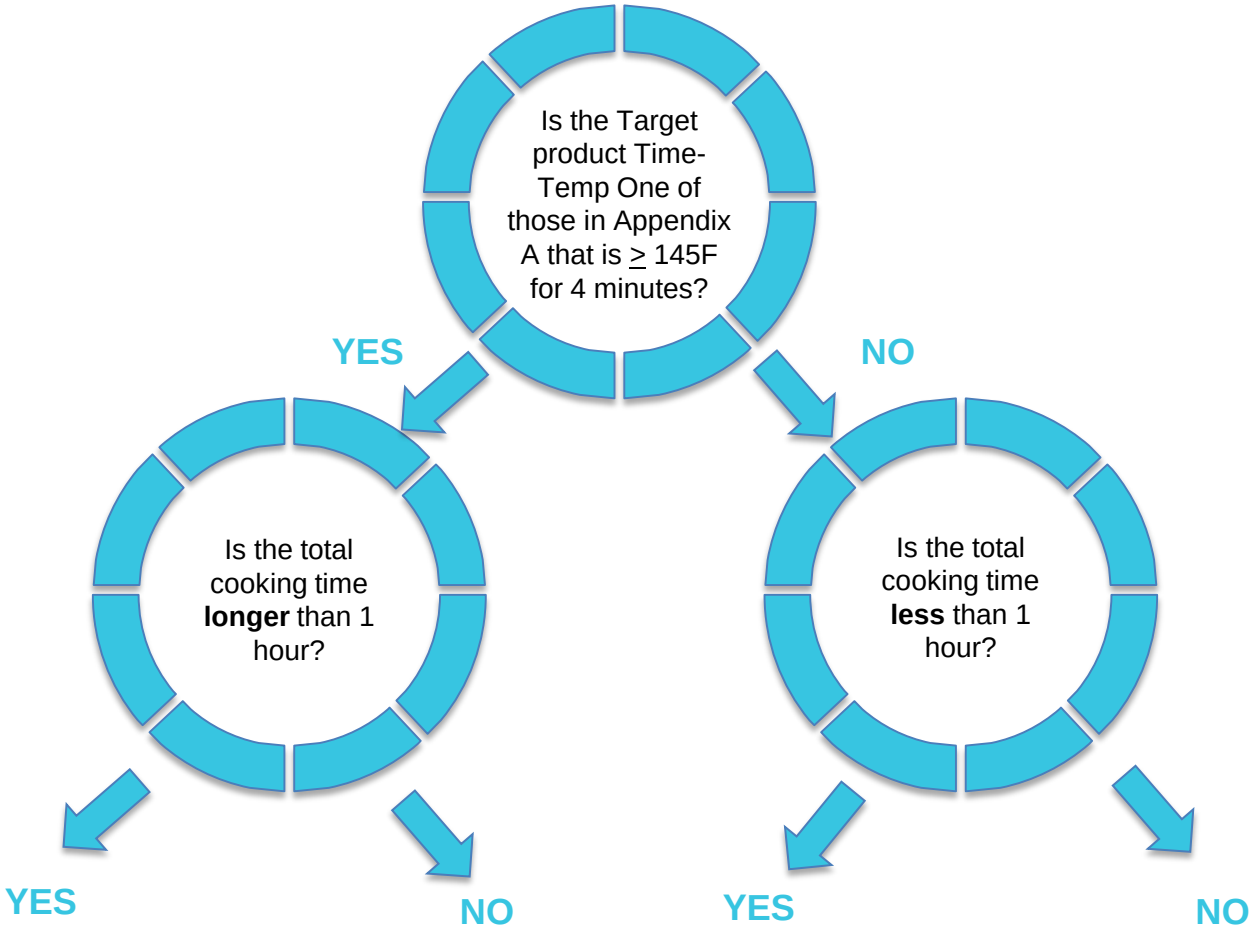

Relative Humidity Options Supportable under Appendix A:

- Steam injection for at least 1 hour or ½ time
- Sealed oven for at least 1 hour or ½ time
- At least 90% RH for at least 1 hour or ½ time**
- At least 90% RH for entire cooking time (<1 hour)

**Products cooked for >4 hours may support 90% RH for ¼ cooking time (no less than 1 hour).

Exceptions to Relative Humidity

Inherently Maintained by Cooking Conditions

- Products ≥10 lbs, if
  - Oven temperature ≥250 °F, and
  - Appendix A time/temperature end point
- Immersion cooking
- Cook-in-bag
- Cooking in casing

Direct heating methods

- Grill,
- Heating coil,
- Flame, or
- Certain rotisserie systems,

Processes that match one of these exceptions do not need to monitor relative humidity as a critical operating parameter in their cooking procedure.

Three Common Types of Heating Deviations

1. The establishment fails to meet a time/temperature parameter in its lethality CCP for meat or poultry products,

2. The establishment fails to maintain sufficient humidity during the cooking step, or

3. Slow heating come-up time occurs which allows product to remain at between 50°F to 130°F for > 6 hours.

- Guideline has information on how to use pathogen modeling and sampling to determine product disposition.

How to use Alternative Lethality (5.0-log Options)

- Establishments may support achieving a 5.0 log reduction (instead of 6.5 log reduction) for **cooked meat products**, with or without a performance standard, if providing additional support.
- Examples of additional support:
  - Use source materials that have been tested or treated to reduce pathogens.
    - Received with Letters of Guarantee (LOG), or Certificate of Analysis (COA)
  - Conduct a baseline study for *Salmonella* in raw source material.
    - Estimate 10 samples per week; 500 samples per year
    - See guideline pages 14-15 for detailed recommendations

IMPLEMENTATION AND NEXT STEPS

FSIS Notice 17-18: Delayed Implementation and Verification of Revised Appendix A and B

Inspector actions until March 22, 2019

- Continue to verify establishment critical operating parameters with the support on file (1999, 2017, or other support)
  - NRs are to be written if establishment does not support their process/follow their support (9 CFR 417.5(a)(1)).
- IPP are not to issue noncompliance record (NR) solely for following the 1999 version of FSIS guidance
  - Even if the establishment is using sections of the 1999 guidance that have been updated in the 2017 guidance.

Next Steps for Lethality (Appendix A) and Stabilization (Appendix B) Guidelines

- FSIS received 52 comments on the *Salmonella* Compliance Guideline and Stabilization Compliance Guideline.
- Through review of these comments, the Agency also identified research needs associated with processes that were not commonly used at the time the original guidance documents were developed (e.g., short time-high temperature cooking).
- In addition, the agency identified additional options and flexibilities were needed for establishments
- The Agency is currently reviewing comments and will issue revised versions of the Guidelines that will be announced in the *Federal Register* with a response to comments as soon as possible.

Research Gaps Related to Lethality and Stabilization

- Support for short-time, high-temperature cooking
  - Validated methods to measure moisture and
  - Validated temperature, time, and moisture parameters.

- Support for lethality treatments for baked goods cooked with raw meat and poultry components where relative humidity in the cooking environment is not desired.

- Support for the conditions that impact when and how natural casings begin maintaining sufficient moisture to ensure product lethality using FSIS time and temperature tables without addressing relative humidity.

- Support for extended come-up and come-down time for partially heat-treated smoked products other than bacon (e.g., hams and sausages) and identification of the active constituents in liquid smoke and natural smoke.

https://www.fsis.usda.gov/wps/portal/fsis/topics/science/food-safety-research-priorities

askFSIS Posted Q&As

- FSIS has posted several new askFSIS Questions about Lethality and Stabilization to help provide clarification in response to commonly asked questions. Links to related questions can be found under FSIS Notice 17-18. New questions include:

  - *askFSIS Questions about Lethality and FSIS Appendix A*
    - Situations When Humidity Is Not Needed During Cooking New

  - *askFSIS Questions about Stabilization and FSIS Appendix B*
    - Part 1 of 3: Use of Celery Powder and Other Natural Sources of Nitrite as Curing Agents, Antimicrobials or Flavorings New
    - Part 2 of 3: Revised Appendix B: Stabilization Option 3 for Products Containing Natural Sources of Nitrite and Natural Sources of Ascorbate or Ascorbic Acid New
    - Part 3 of 3: Formulating Products Containing Natural Sources of Nitrite and Natural Sources of Ascorbate When Using Revised Appendix B: *Stabilization* Option 3 New
    - Part 1 of 2: Recommendations For Establishment That Cannot Meet The 2017 Stabilization Guideline Revised Appendix B New
    - Part 2 of *2*: Recommendations For Establishments That Cannot Meet The 2017 Stabilization Guideline Revised Appendix B New

Questions?

http://askfsis.custhelp.com/