BACON PROCESSING TODAY

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Goals

- Maximize Value from the Pork Belly
- Uniform, Consistent & High Quality Bacon
- Good Color, Shelf Life, Consumer Value & Expectations
- Greater “Consistency” - Freedom From Defects
- Expand Product Development Opportunities
- Compliance with Regulatory Requirements

Definition

- **Bacon: The weight of cured pork bellies ready for slicing and when labeled as "Bacon" shall not exceed the weight of the fresh uncured pork belly.**
  - **DRY CURED - Curing materials applied in dry form to belly surfaces**
  - **IMMERSION CURED - Bellies are immersed in a curing solution**
  - **PUMPED - Machine injected**
    - **Stitch needle type**
    - **Spray needle type**

What Is Bacon Today?

- Injected/Pumped Bacon = 97+% of bacon produced
- Dramatic Change in Demand and Usage
- Highly demanded ingredient for sandwiches, salads, hand held foods, appetizers, casseroles
- “FLAVOR – TEXTURE – EYE APPEAL”
- Bacon is a highly sought out speciality product
- Condiment/Ingredient for Flavor, Texture, Eye Appeal

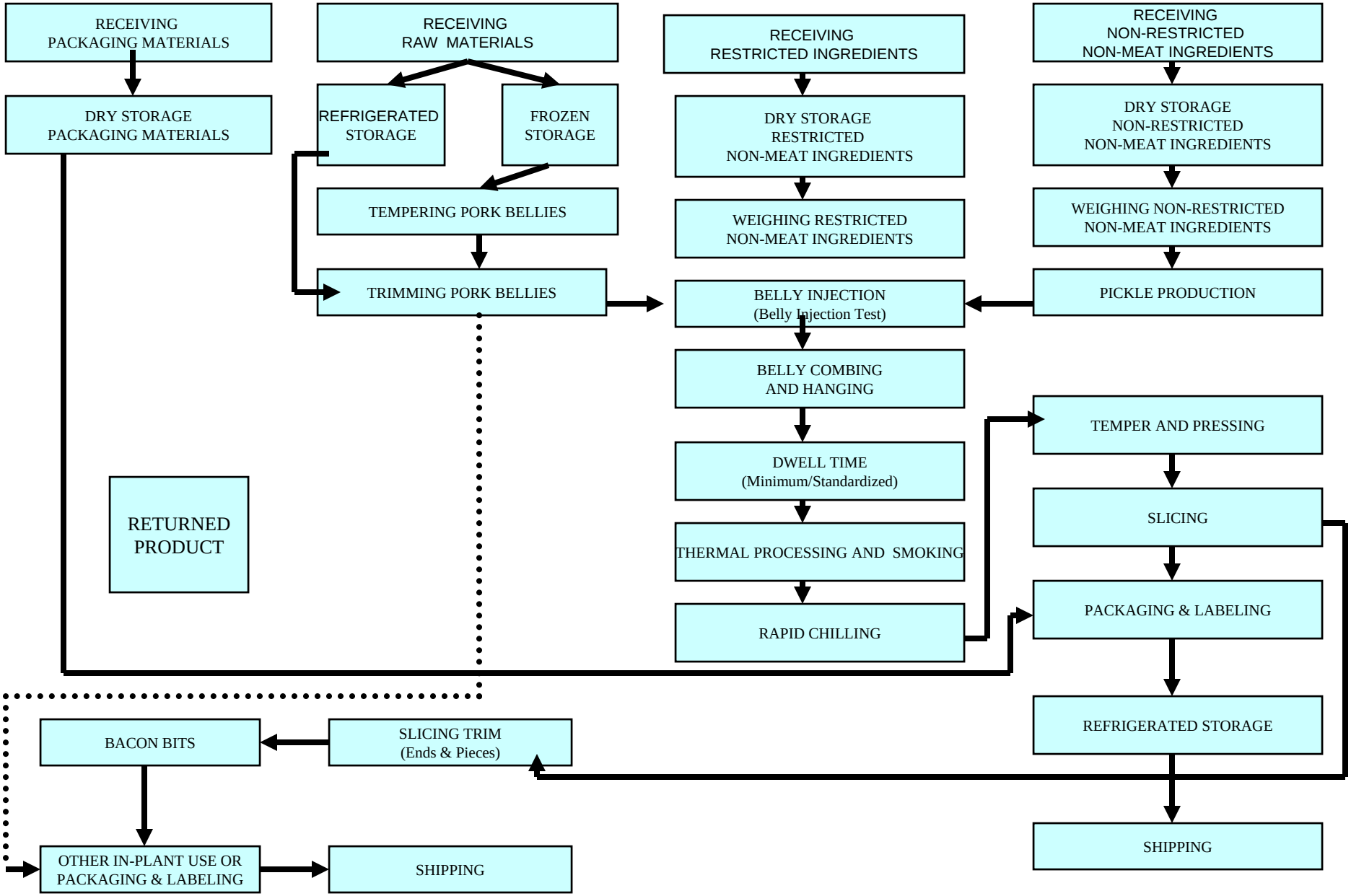
What is the Impact of Bacon?

- 108,000,000 pigs / year U.S.
- $13.09 lb/pig
- 1,413,720,000 lb bellies
- $ 18.5 Billion
- 212,058,000 lb bellies for single rib export – 15%

- HOG CUT OUT DATA - (Week 5/25/2009
  - Loins $76.06/cwt
  - Bellies $77.19/cwt
  - Butts $72.46/cwt
  - Hams $45.06/cwt

TABLE 1.SLICED BACON: PROCESS FLOW DIAGRAM

PROCESS CATEGORY : HEAT TREATED, NOT SHELF STABLE SLICED BACON



INGREDIENTS

- **Meat Ingredients**
- **Non-Meat Ingredients**

Source of Bellies

- **Pork Carcass**
- **NAMP #408 skin-on**
- **NAMP #409 skinless**
- **NAMP 409A**
  - **export, single-rib**
- **Sorted and marketed by weight range**
- **Typically shipped fresh in bulk quantities**

The Pumped Bacon Regulations

- 120 ppm Sodium Nitrite (In-going Target)
- 550 ppm Sodium Ascorbate (In-going Target)
- Green Weight Regulation

Code of Federal Regulations
9 CFR 318.7, 319.107
FSID Directive
7310.6

Standard Operating Procedures

- Pickle Formulation
- Pre-Pump Handling of Bellies
- Pumping Operations
- Post-Pump Handling of
- Regulatory Requirements
- Taste and Quality Level
- Injection Percentage
- Thermal Processing Schedule
- Slicing, Grading, Packaging Standards

Pickle Composition

Ingredient	Function	Limits
Water	Carrier & Yield	Green Weight Rule
Salt	Flavor & Anti-Microbial	Flavor Profile
Sodium Nitrite	Cure- Color Development Anti-Microbial	120 ppm
Sodium Ascorbate	Cure Accelerator	550 ppm
Sodium Phosphate	Moisture Balance	5000 ppm
Sugar	Sweetener	Flavor Profile
Soluble Flavorings	Flavor Profile/Coatings	Flavor Profile

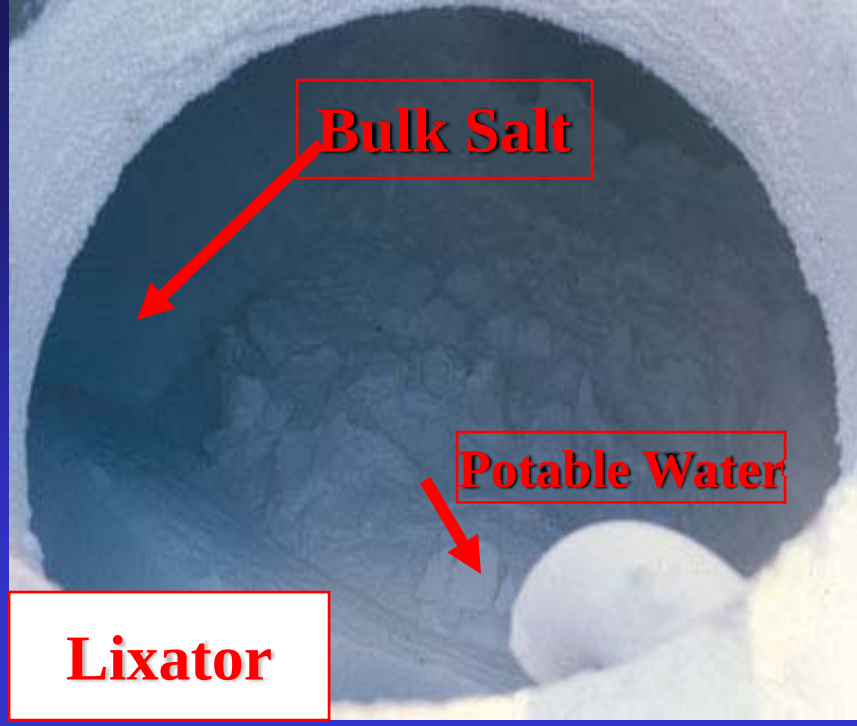
Non-Meat Ingredients

- Bulk Ingredients
  - Sanitation of Bulk Delivery Trucks
  - Condition of Lixator, Saturation Tables
- Bagged Ingredients
  - Removal of Outer Bag
  - Ingredient Purity
- Security of Regulated Ingredients
  - Sodium Nitrite or Cure, Sodium Ascorbate/Erythorbate
- Weight vs. Volume Measurements

1

Lixator

2



Lixator

3

Mixing Tanks

4

NO Dip Sticks

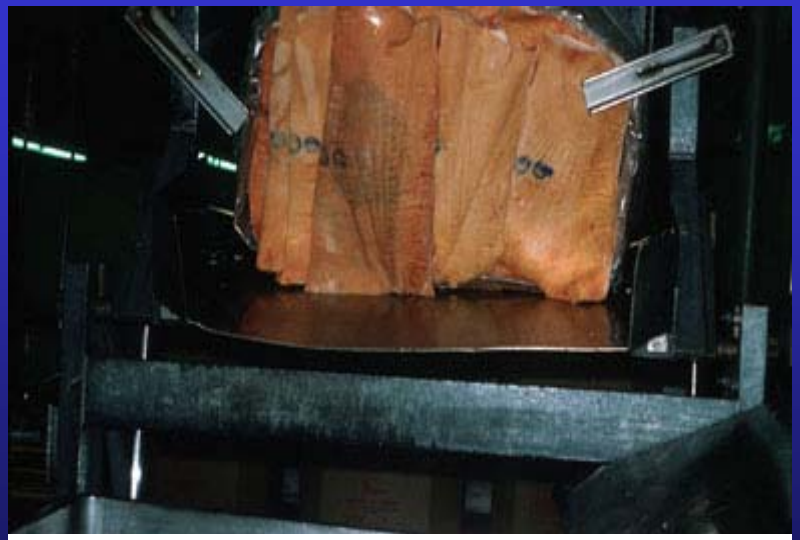
1

Digital Scale

2

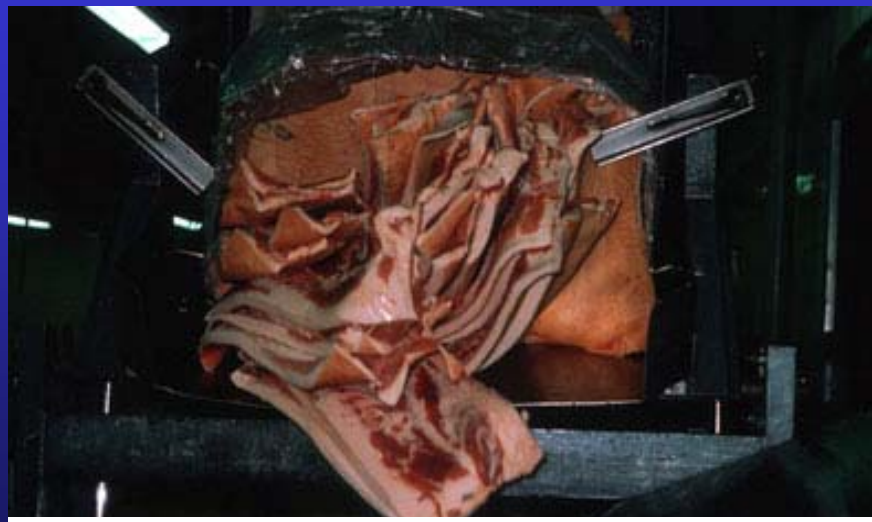
Air Agitated Mixing

3



Frozen Bellies

4



Fresh Bellies

1

Cold Water Soaking

2

Skinning

3

Whizzard Knife Trimmed

4

Fresh Bellies Injection

1

Combing

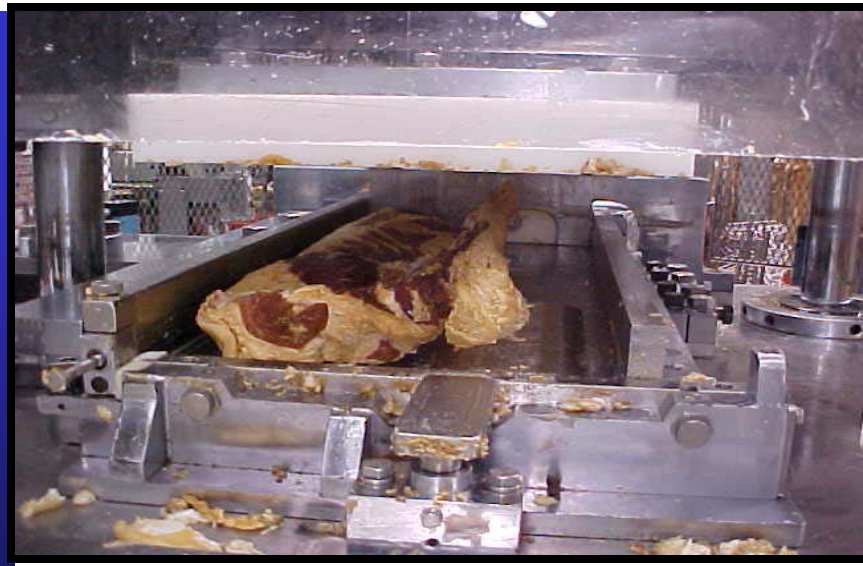
2

Dwell/Diffusion/Staging

3

Blast Chill/Tempering

4

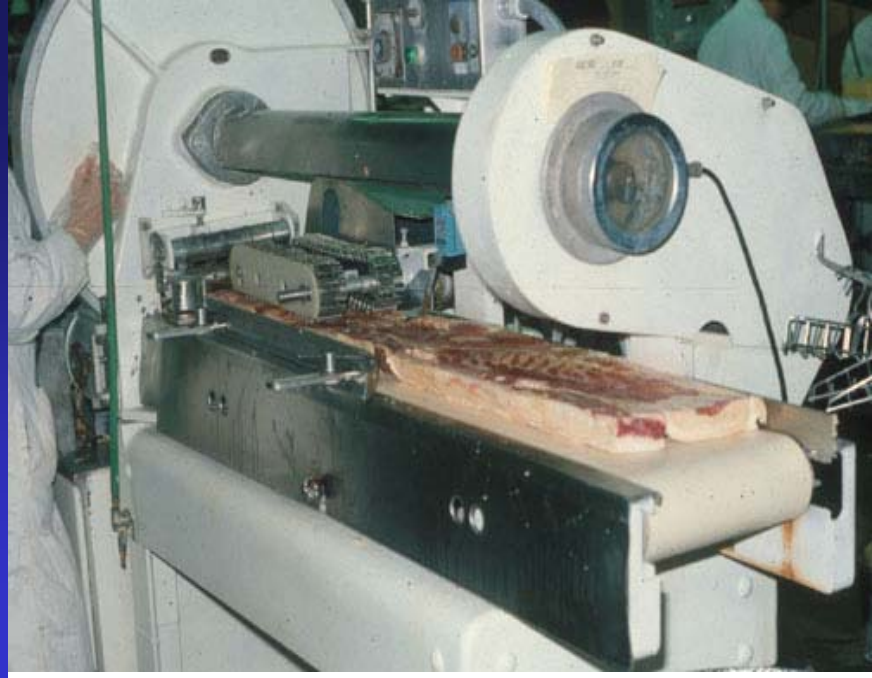


Pressing Tempered Slab

1

Pressed Bacon Slab

2

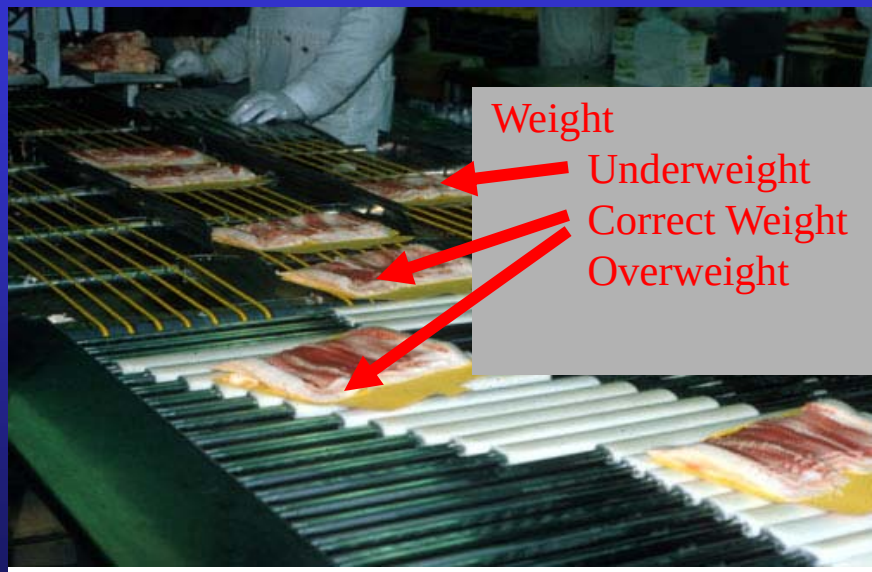


Bacon Slicer

3

Sliced Bacon Draft

4



Net Weight

Order of Ingredients

- 1. Water
- 2. Phosphates, Ascorbates/Erythorbates
- 3. Salt, Sugar, Dextrose, Flavorings
- 4. Nitrites

Pumping Percent

- **Desired Percent = 10-18%**
- **Skin-on vs. Skin-off Bellies ~ 10% difference**
  - **120 ppm = 94-144 ppm (±20%)**
  - **550 ppm = 440-660 ppm (±20%)**
- **Green Weight Regulations**

Things to Remember!

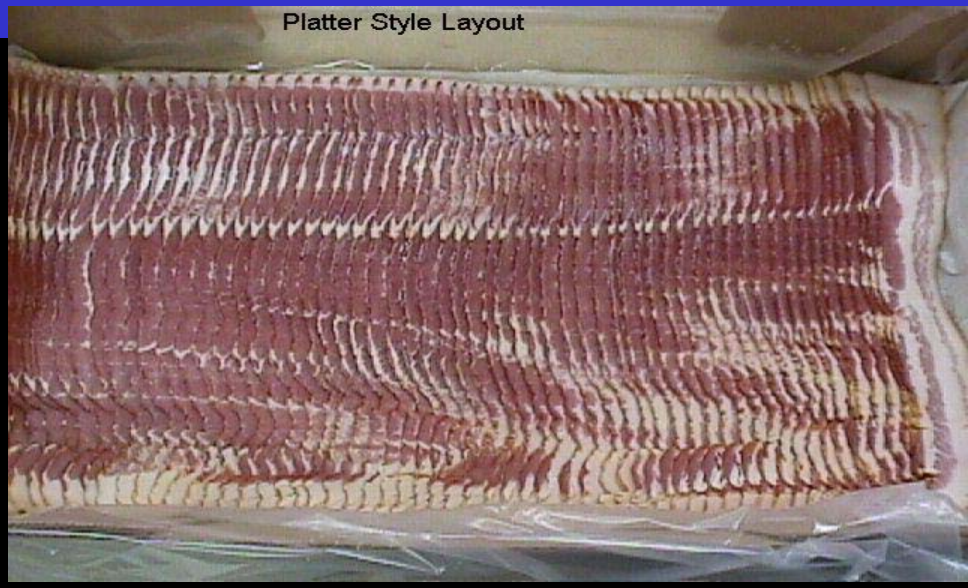
- Weights not Volumes
- Pre-mix – Unit-Packs – Complete Cures
- Mechanical Agitation – Never Direct Air or Steam
- Gentle Not Violent (trapped air & protein foam)
- Cold Brines – Never Hot – Always < 40°F (5°C)
- Never Overnight – Always < 12 Hours Old
- Never Reuse Pickle from yesterday

SAMPLE CALCULATIONS

• Pounds of Pickle Desired	500#
• Pumping Percentage	0.12
• Percent Nitrite – 120 ppm	0.00012
• Percent Ascorbate – 550 ppm	0.00055
• Percent Salt	0.02
• Percent Sugar	0.0075
• Percent Phosphates	0.0050
• Percent Flavorings	0.0000

SINGLE SLICE LAYOUT

PLATTER STYLE LAYOUT



ACCEPTABLE SHINGLING

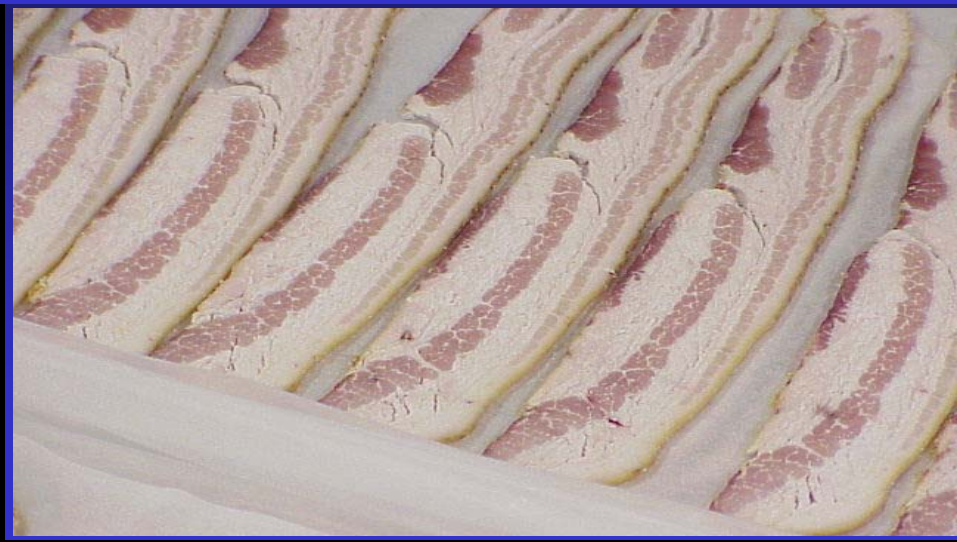
BULK BOXED BACON

BACON DEFECTS

- Shattered Bacon
- Lacy Bacon/Pickle Pockets
- Abscess Deep in Belly
- Abscess Below Spareribs
- “Seedy Belly”
- Tiger Striped Bacon (Needle Injector Patterns)
- Tiger Striping (Needle Pattern)
- Tiger Striping (Complete Cure-Different Intensities)
- Two-Toned Bacon
- Poor Quality Bacon
- Wrinkled Bacon
- Vertical Splits
- Dog Ear Bacon
- Severe “S” Folding
- Cooked Slice Distortion

SHATTERED BACON

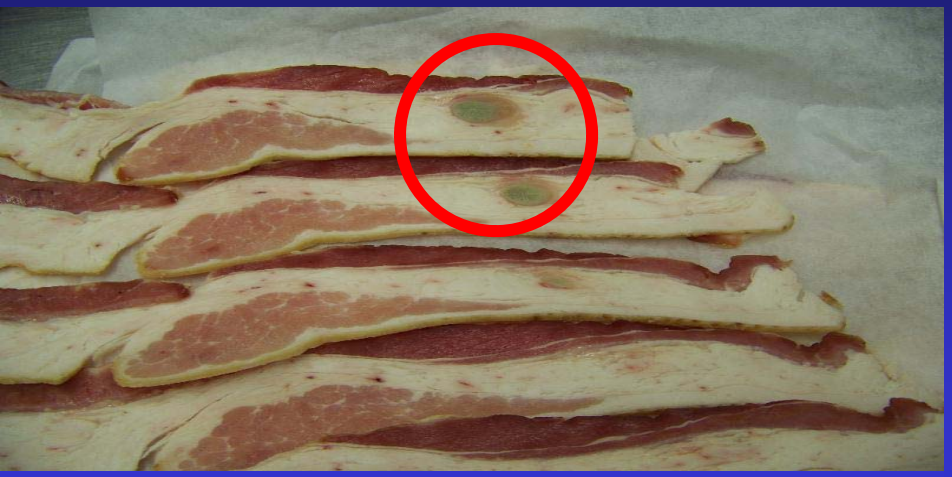
SHATTERED BACON



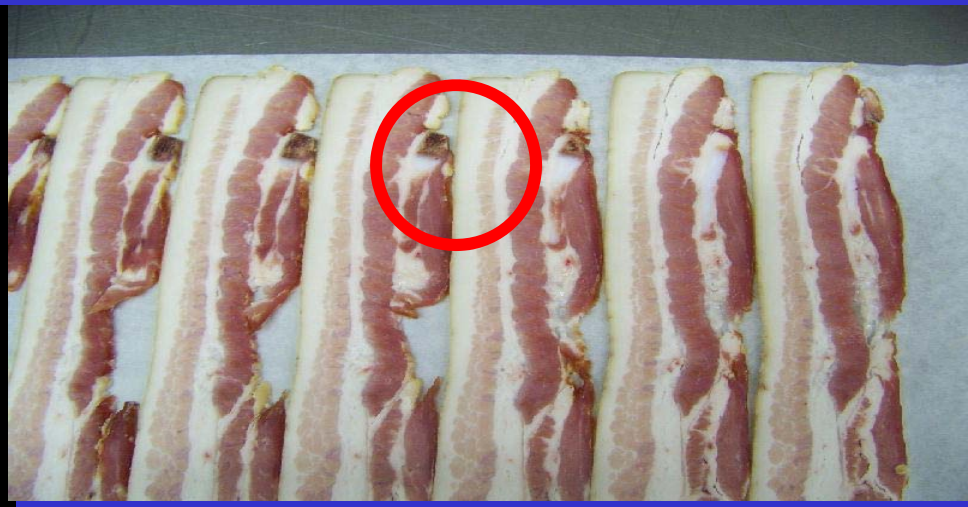
SHATTERED BACON

LACY BACON/PICKLE POCKETS

ABSCESS DEEP IN BELLY



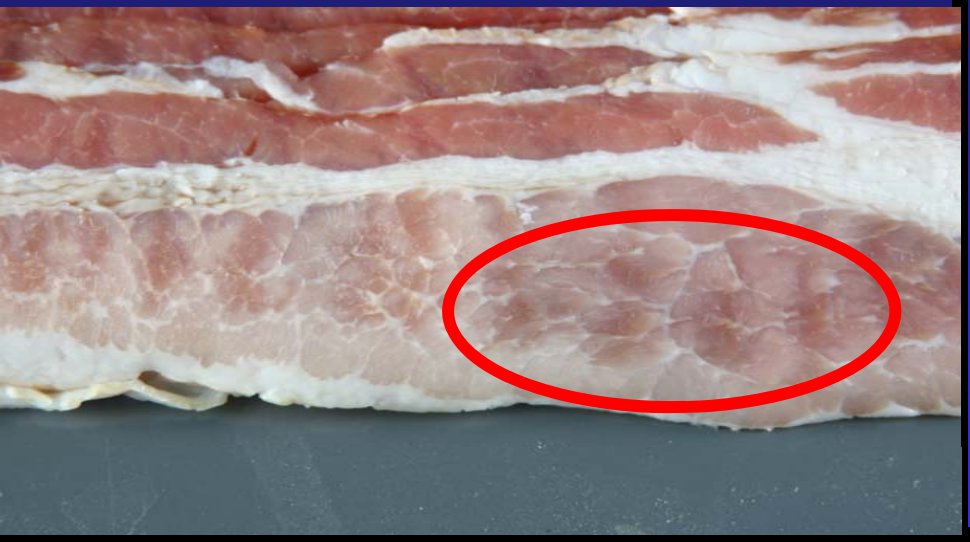
ABSCESS BELOW SPARERIBS



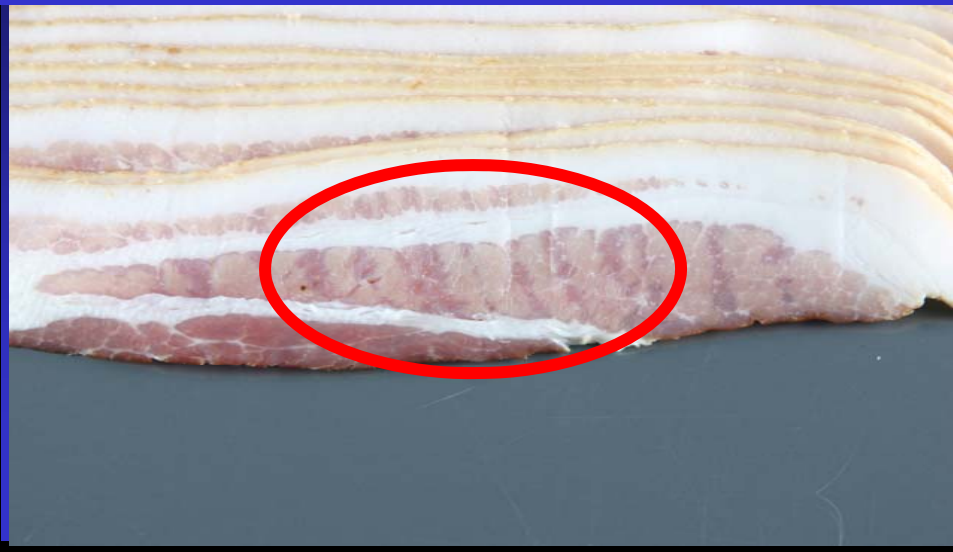
“SEEDY” BELLY

TIGER STRIPED
(Needle Injector Patterns)

TIGER STRIPING
Needle Pattern

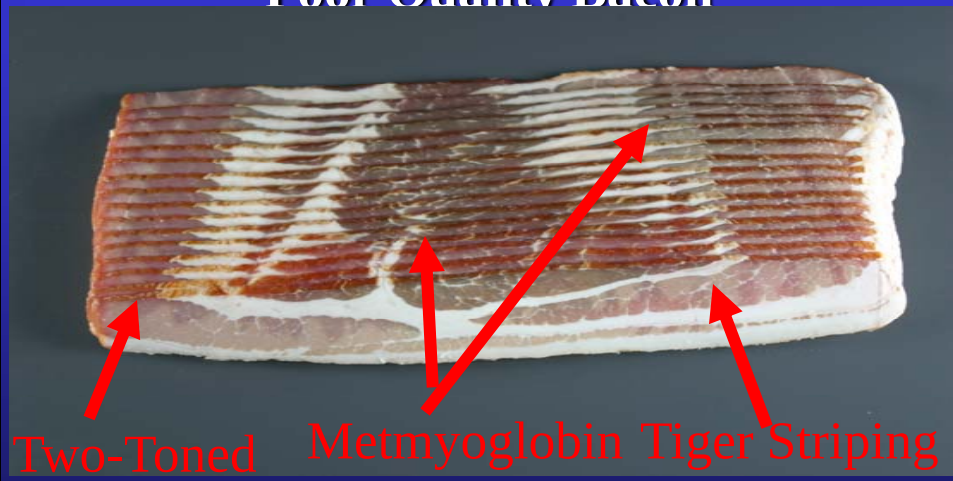


TIGER STRIPING
Complete Cure – Different Intensities

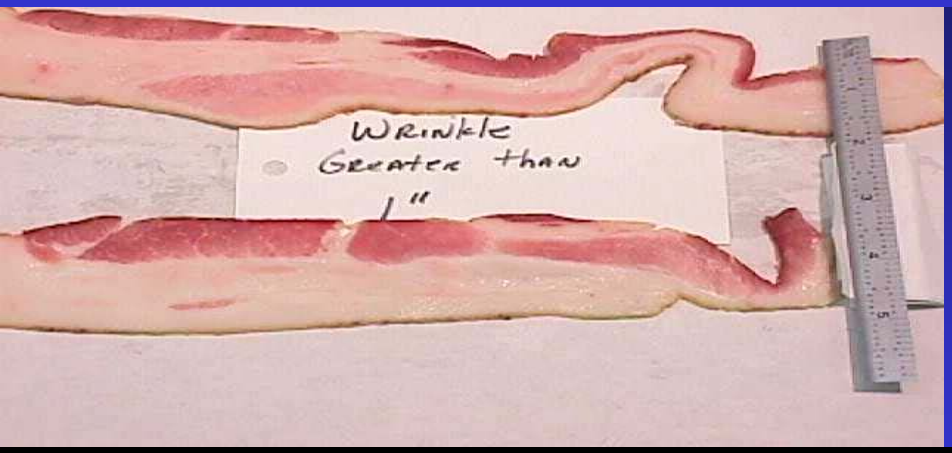


Two Toned Bacon

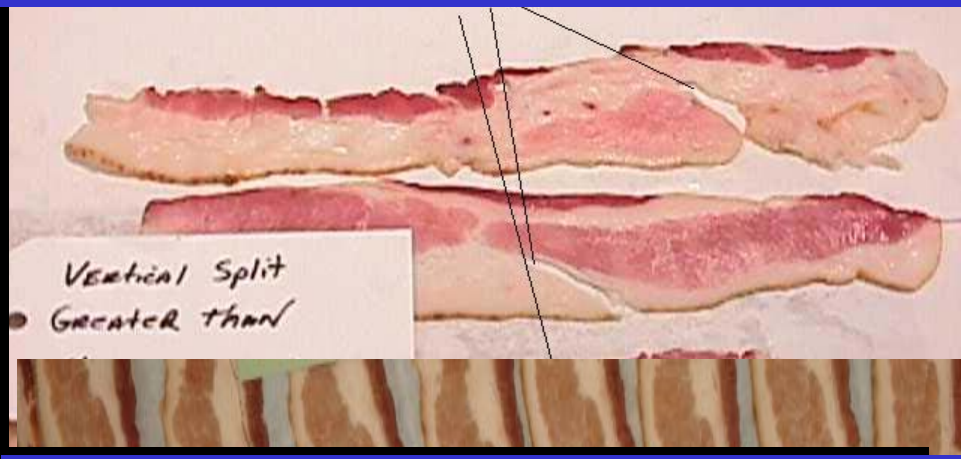
Poor Quality Bacon



WRINKLED



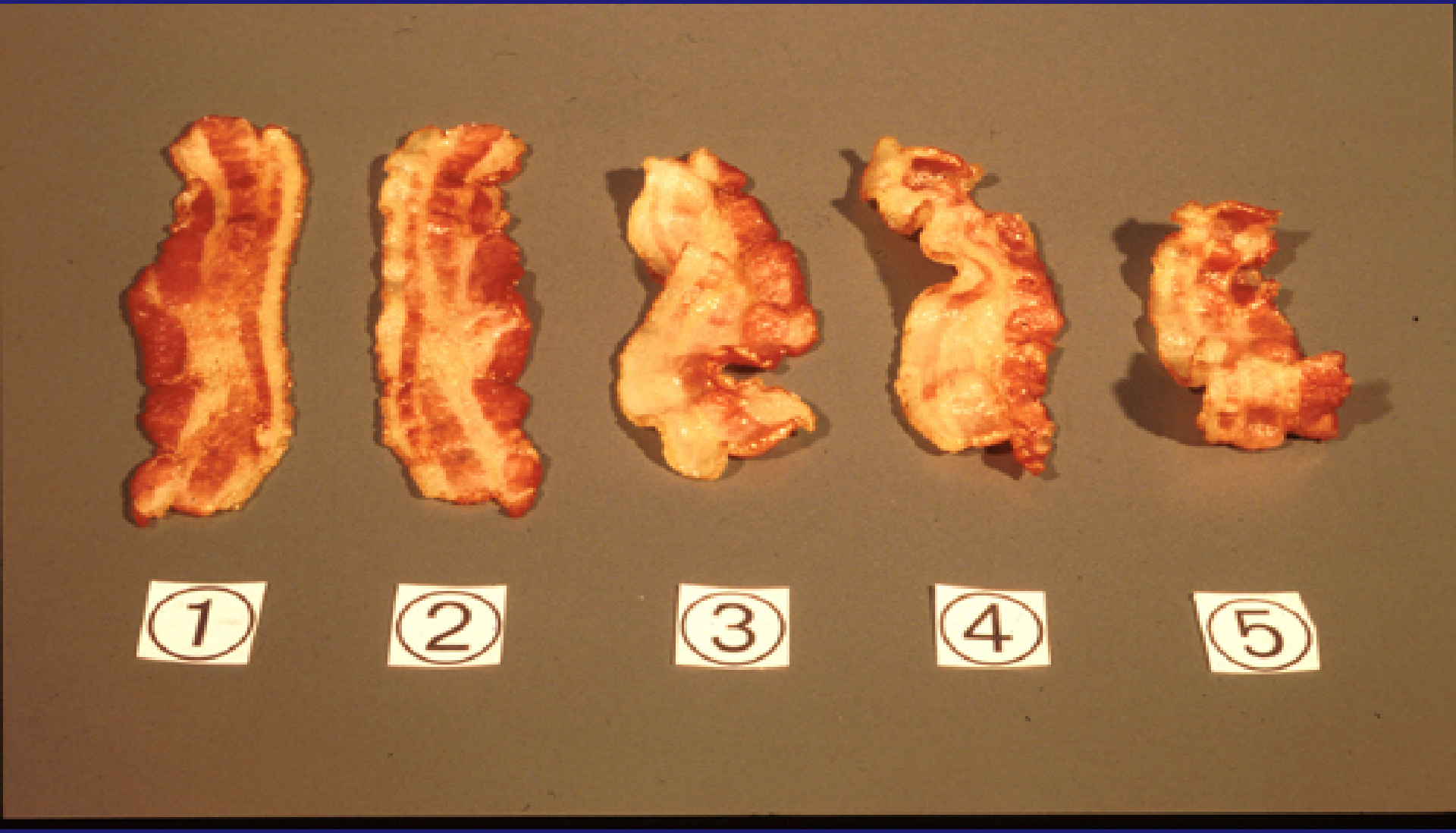
VERTICAL SPLIT



DOG EAR

SEVERE “S” FOLDING

Cooked Bacon Slice Distortion



PRODUCTION

- Making Pickle
  - Calculations
    - Nitrite
    - Ascorbate
    - Salt
    - Sugar
    - Phosphate
    - Water
- Making Bacon

Pickle **Ingredient** Calculation

- **500 pounds of pickle**
  - **12 percent injection level**
  - **120 ppm nitrite**
  - **550 ppm ascorbate**
  - **2 percent salt**
  - **0.75 percent sugar**
  - **0.5 percent phosphate**

Nitrite Calculation

- **Formula: Percent (as decimal) required in bacon *divided by* percent (as decimal) pump *equals* percent (as decimal) in pickle.**
- **Assume 120 ppm=.012 percent=.00012 (percent as decimal)**
- **Nitrite= .00012* percent in bacon divided by .12* percent pump =.001* percent in pickle x 500# of pickle = 0.5# nitrite**

***percent as decimal**

Ascorbate Calculation

- **Formula: Percent (as decimal) required in bacon divided by percent (as decimal) pump equals percent (as decimal) in pickle**
- **Assume 550ppm=.055percent=.00055 (percent as decimal)**
- **Ascorbate = .00055* percent in bacon divided by .12* percent pump = .00458* percent in pickle x 500# of pickle = 02.29# ascorbate**

***percent as decimal**

Salt Calculation

- Formula: Percent (as decimal) required in bacon divided by percent (as decimal) pump equals percent (as decimal) in pickle
- Assume 2.0 percent=.02 (percent as decimal)
- Salt= .02* percent in bacon divided by .12*percent pump =.166* percent in pickle x 500# of pickle =83.0# salt

*percent as decimal

Sugar Calculation

- **Formula: Percent (as decimal) required in bacon divided by percent (as decimal) pump equals percent (as decimal) in pickle**
- **Assume 0.75 percent=.0075 percent (as decimal)**
- **Sugar= .0075*percent in bacon divided by .12*percent pump = .0625*percent of pickle X 500# of pickle = 31.25# sugar**

***percent as decimal**

Phosphate Calculation

- **Formula: Percent (as decimal) required in bacon divided by percent (as decimal) pump equals percent (as decimal) in pickle**
- **Assume 0.5 percent = .005 percent (as decimal)**
- **Phosphate = .005*in bacon divided by .12 *percent pump = .042 *percent in pickle X 500# of pickle = 20.83# phosphate**

***percent as decimal**

Water Calculation

Total of dry ingredients

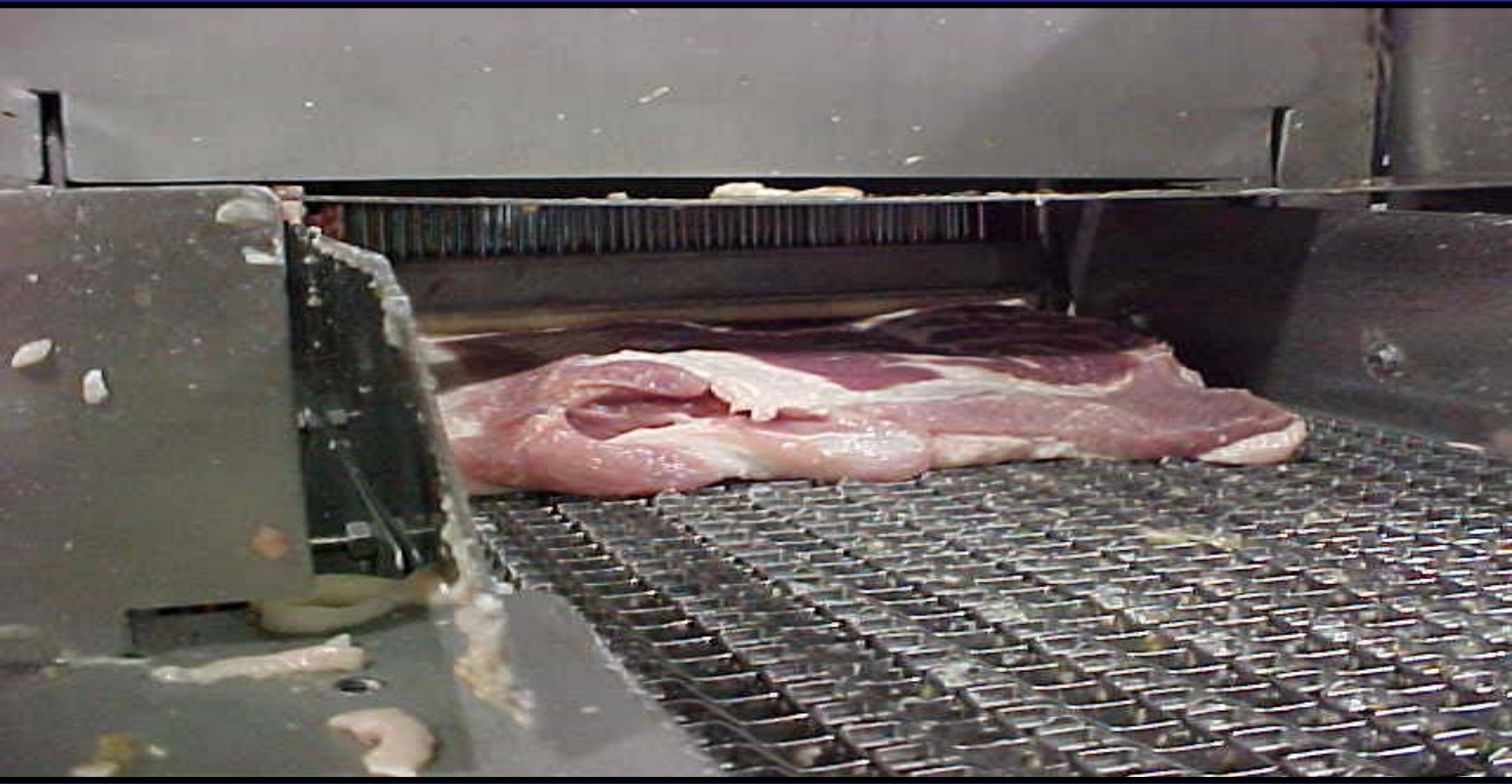
- **0.5 lbs nitrite + 2.29 lbs. ascorbate + 83 lbs. salt + 31.25 lbs. Sugar + 20.83 lbs. Phosphate =137.87 lbs.**
- **Water = 500 lbs. Batch weight – 137.87 lbs. dry ingredients = 362.13 lbs. of water**

- **Water at 40 degrees F and at sea level, = 8.33 lbs. Per gallon**
- **362.13 lbs. of water divided by 8.33 = 43.47 gallons**

Pickle Making

- Pickle Making Guidelines
  - Formulate pickle batches as small as possible, yet economical for the operation, weigh all ingredients
  - Completely dissolve ingredients in proper order
  - Don’t re-circulate pickle to mixing tanks
  - Don’t save pickle overnight
  - Use standardized quantities of ingredients, check net weight

Belly Injection

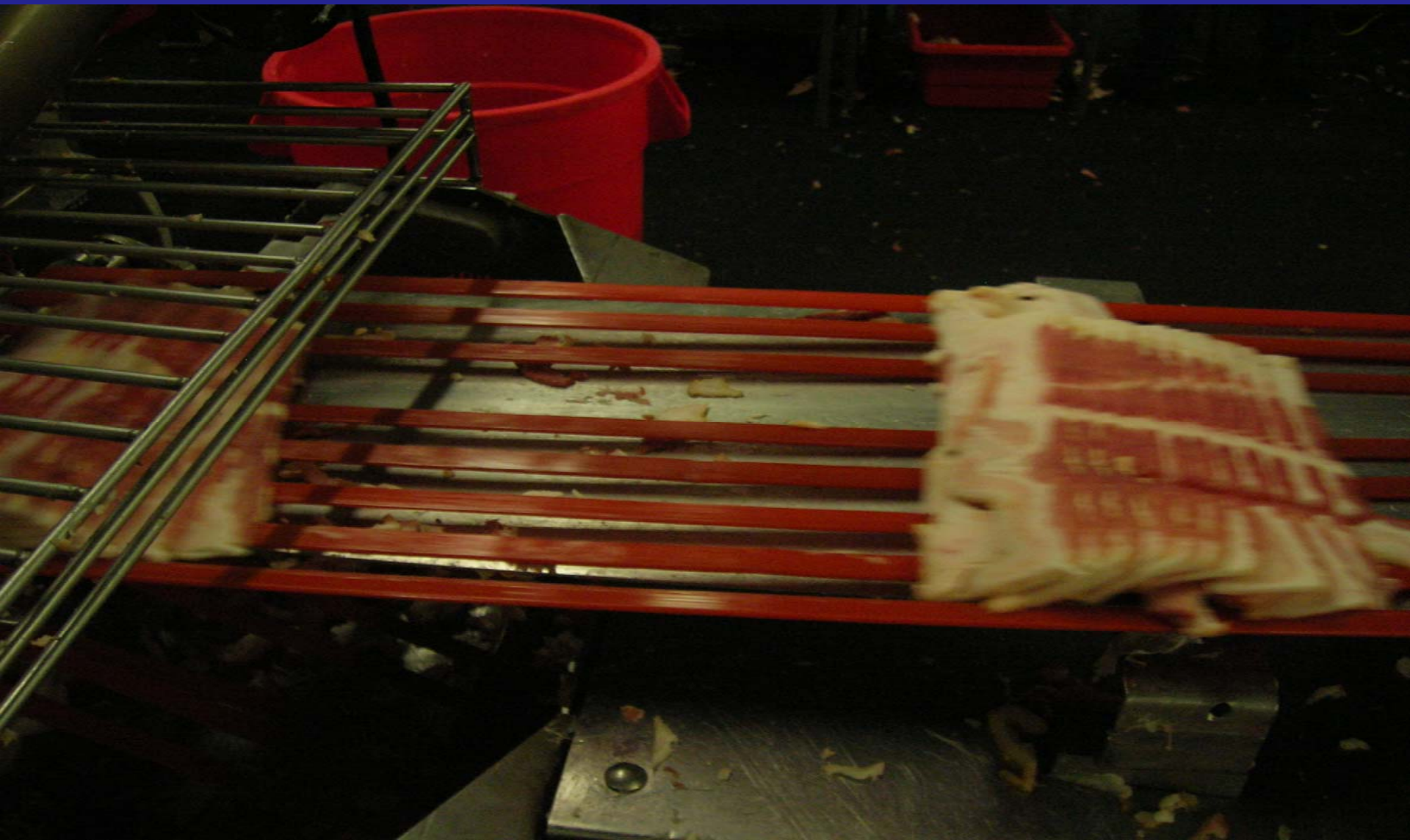


Smoking

Smoking

- Temperature and Relative Humidity
  - Follow an established cook schedule
  - Calibrate wet and dry bulb controllers
  - Change wet bulb sock regularly
  - Use thermocouples to monitor oven and internal product temperatures
  - Remove bellies at consistent temperatures

Bacon Slicing



Bacon Slicing

PRE-COOKED BACON

- Pre-Cooked Bacon
  - Premium Slices – Microwaveable & Convenient
- Continuous Cooking
- Bacon Ends & Pieces

Continuous Cooking

Pre-Cooked Bacon

The Pumped Bacon Regulations

1. 120 ppm Sodium Nitrite (In-going Target)
2. 550 ppm Sodium Ascorbate (In-going Target)
3. Green Weight Regulation
4. Pre-Cooked Bacon
   – Not to yield more than 40% bacon
   = 60% shrink (Green Weight)

Bacon Ends & Pieces

Applewood
Cherrywoo
Mesquite
or
Cracked Pepper

ZIP PAK RESEALABLE PACKAGING ZIP PAK RESEALABLE PACKAGING ZIP PAK

72 SLICES

Hormel

Black Label® Bacon SMOKE FLAVORING ADDED

FULLY COOKED MICROWAVEABLE

SERVING SUGGESTION

PREPARE OR FREEZE BY

DEC 20 2007 E 6

EST. 1992

Nutrition Facts

Conventional Oven: Heat oven to 400°F. Remove bacon from paper and place desired amount in single layer on baking sheet. Heat 2 minutes or to desired crispness.

Convection Oven: NOT RECOMMENDED.

NOTE: Cooking times are guidelines as individual ovens may vary.

0 37600 18996 5

NET WT 9.5 OZ. (269g

REFRIGERATE AFTER OPENING

Cured with Water, Sugar, Salt, Smoke Flavoring, Sodium Phosphates, Sodium Erythorbate, Sodium Nitrite.

Distributed by Hormel Foods Sales, LLC, 1 Hormel Place, Austin, MN 55912

50047596-03

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Questions or comments, please call 1-800-523-4635 or visit us at www.hormel.com

Hormel
Real
Crumbled
BACON
WITH PICNIC BACON
SMOKE FLAVORING ADDED
50% LESS FAT
Original
NET WT 20 OZ (1 LB 4 OZ) 567

At Last – The End!

Acknowledgements

Special thanks and appreciation are extended to the following for contributions and assistance with this presentation:

Larry Hand – Smithfield Foods, Inc.

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David Meisinger, U.S. Pork Center of Excellence

Jack Kish – Stork-Townsend Inc.

Don Holms – Stork-Townsend, Inc.

et.al.

Questions?

1. How will genetics and market weight impact the future of bacon?
2. How will the cost of feed (grains, distillers byproducts, flax seed feeds, restaurant grease and competition with corn) affect bacon?
3. What role will special label claims such as natural, organic, Omega 3 fatty acids, impact the bacon industry?
4. Which bacon defects have quick solutions?
5. Will bacon popularity and consumption continue to increase?