Controlling *Campylobacter* in Poultry Plants

For the FSIS “How to” Workshops
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Presented by
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By the end of this workshop, you will be able to

- Understand the bacterium *Campylobacter* and its risk factors
- Identify practical tools and methods to control *Campylobacter*
- Develop and implement controls for *Campylobacter* in your operations
Campylobacter

- Slender, curved, and motile rod
- Gram negative
- Relatively fragile and sensitive to environmental stresses
- Microaerophilic organism requires 3%–5% oxygen and 2%–10% carbon dioxide for optimal growth conditions
Campylobacter (con’t)

- Carried in the intestinal tract of a wide variety of wild and domestic animals
- Can survive 2–4 weeks under moist, reduced-oxygen conditions at 4°C
- Can also survive 2–5 months at 20°C
- Can only survive a few days at room temperature
- Exposure to air, drying, low pH, heating, and freezing and prolonged storage damage cells and hinder recovery
- Infective dose ranges from 500 to 10,000 cells
Currently, FSIS does not have a performance standard for *Campylobacter*

FSIS plans to test and report *Campylobacter* results to plants as it does for *Salmonella*

The broiler baseline currently in progress is intended to establish standards for *Campylobacter* in the form of guidance
Risk Factors Associated with Sporadic Illness Due to *Campylobacter* spp.

- Eating undercooked poultry
- Handling raw poultry
- Frequent contact with dogs or cats, particularly young pets, such as kittens and puppies
- Drinking non-potable water
- Drinking unpasteurized milk or dairy products made from non-heat-treated milk
- Eating barbequed poultry, pork, or sausages
- Eating poultry liver
- Taking trips abroad

Adapted from Opinion of the Scientific Committee on Veterinary Measures relating to Public Health on Foodborne Zoonoses
Preharvest Control

*Campylobacter* is more difficult to control through on-farm practices than *Salmonella*.
Preharvest *Campylobacter* Control

- **Restricting access**
  - Vehicles
  - People
  - Animals
  - Insects

- **Biosecurity**
  - Dedicated clothing and boots
  - Disinfectant boot dip
Preharvest *Campylobacter* Control *(con’t)*

- **Feed**
  - Heat-treated
  - Pelletized

- **Litter**
  - Maintain low water activity

ARS Photo by Stephen Ausmus
Recommended Preharvest Best Practices

- Implement biosecurity measures
- Use good sanitation practices
- Control insects and rodents
- Control litter moisture
- Use well-timed feed withdrawal
- Use acids in drinking water during feed withdrawal

ARS Photo by Stephen Ausmus
Discussion Questions

- What do you know about the live birds from which you are producing product?
- Do you know the level of *Campylobacter* contamination?
A poultry HACCP plan should address *Campylobacter*

Verification of the HACCP plan’s ability to control *Campylobacter* is suggested
Sanitation

What role does sanitation play in controlling *Campylobacter*?
Plants may address *Campylobacter* control in their sanitation standard operating procedure (SOP) or other prerequisite program.

How effective is YOUR sanitation program in controlling *Campylobacter*?
Sanitation and Hygiene

- Clean before sanitizing
- Enforce employee hygiene
Sanitation and Hygiene (con’t)

**Alkaline Detergents**
- Sodium hydroxide
- Nitrous oxide
- Sodium silicate
- Trisodium phosphate

**Acid Detergents**
- Hydrochloric acid
- Sulfuric acid
- Phosphoric acid
- Acetic acid

Note: Frequently used and vary in strength

Note: Vary in strength
Sanitation and Hygiene (con’t)

- **Sanitizers**
  - Quaternary ammonia*
  - Industrial strength bleach
  - Iodine compounds
  - Peracetic acid
  - Steam
  - Ozone

- **Some sanitizers work better in certain parts of the plant**
  - Iodophors
    - Aluminum equipment, rubber belts, tile walls
  - Active chlorine
    - Walls (other than tile), wooden crates, concrete floors

*Quaternary ammonia is a type of synthetic detergent.
Recommended best practices

- Sanitize and dry cages thoroughly
- Maintain positive air flow from inside to outside the plant
- Provide SOP and employee training
- Schedule flocks for slaughter based on pathogen loads
Recommended best practices

- Consider electrical stunning
  - Cheapest and most effective method
- Use well-timed feed withdrawal to reduce feces release
Scalding

- Recommended best practices
  - Use counter-flow water movement
  - Use high flow rates with agitation to help dilute dry matter and bacteria
  - Use multi-stage tanks
  - Maintain pH above 7.5 or below 6.5
  - Use pre-scald brushes to help clean birds before entering scalder
  - Use post-scald rinse to help remove debris
  - Maintain scalder temperature
Recommended best practices

- Prevent feather buildup on equipment
- Rinse equipment and carcasses
- Use 18–30 ppm chlorine rinse post-picking
Evisceration

- Recommended best practices
  - Adjust and maintain equipment regularly and as needed
  - Use 20 ppm chlorine for whole carcass rinses
  - Enforce employee hygiene standards

Note: Feed withdrawal practices affect process control at this step.
Evisceration (con’t)

- Carcass rinses
  - 23 ppm free available chlorine
  - 10% TSP (trisodium phosphate)
  - 2% lactic acid
  - 5% sodium bisulfate
  - 5% cetylpyridinium chloride

- Be aware how chemical residues can impact pH of chiller

Note: Multiple washes in a series are more effective than a single wash for Campylobacter.
Immersion Chilling

- If using chlorine, maintain chill water pH between 6.0 and 6.5, and at a temperature of less than 40°F
- Use high water flow rate and counter-current flow
- Use 20–50 ppm free available chlorine in the potable water measured at intake
- Use oxidation reduction potential pH with pH monitors

Note: Correlation between *E. coli* and *Campylobacter*.
Immersion Chilling (con’t)

- 10 ppm free available chlorine can eliminate *Campylobacter* in 120 minutes
- 30 ppm free available chlorine can eliminate *Campylobacter* in 6 minutes
- 50 ppm free available chlorine can eliminate *Campylobacter* from the water in 3 minutes

**Note:** Organic matter in the chiller binds the free chlorine, thus making it unavailable.
Factors Affecting Chiller Water Quality

- High flow rate (1 gallon per bird)
- Counter-current water flow
- 20–50 ppm free available chlorine measured at intake
- Red water (recycled water) may contain up to 5 ppm free available chlorine measured at intake
- Water pH 6.0–6.5
- Water temperature less than 40°F
Air Chilling

- Meet regulatory requirements for chilling
- Clean and oil chains regularly
- Inspect and replace shackles as needed
- Maintain tension on chain to prevent carcass-to-carcass contact
- Sanitation is important—no chemical interventions
Reprocessing

- Use post-chill antimicrobial dips to reduce *Campylobacter* loads
- Heated water, agitation, application under pressure, and calibrating pH can enhance *Campylobacter* reduction
Reprocessing: Approved Substances

- Chlorine, chlorine dioxide, and acidified sodium chlorite
  - Water soluble
  - Spray or dip
  - Agitation and application under pressure enhance effectiveness

Note: 10 ppm free available chlorine can eliminate *Campylobacter* in 113 minutes. *Campylobacter* can be eliminated in water in 6 minutes with 50 ppm.
- **Chlorine**
  - Primarily used to treat processing and chiller water
  - Heat and pH above 6.5 decrease its effectiveness

- **Chlorine dioxide**
  - Can be used in water
  - Leaves no residue
  - Should NOT exceed 3 ppm residual chlorine dioxide
Reprocessing: Approved Substances (con’t)

- Acidified sodium chlorite
  - Combination of citric acid and sodium chlorite
  - Can be used as spray or dip at 500 to 1,200 ppm singly or in combination with other GRAS acids to achieve a pH between 2.3 and 2.9 as an automated reprocessing method
  - In chiller water, it is limited to 50 to 150 ppm singly or in combinations with other acids to achieve a pH between 2.8 and 3.2
Reprocessing: Approved Substances (con’t)

- Trisodium phosphate (TSP)
  - Approved for on-line reprocessing
  - Acts as a surfactant (high pH)
  - Residual TSP carries over into chiller
    - Must monitor pH of chiller water
  - Rinsing carcasses after TSP but prior to chiller decreases its effectiveness
  - More effective with air chilling than immersion chilling
Cetylpyridinium chloride
- Quaternary ammonium compound
- Approved for processing in ready-to-cook poultry products
- Produces no adverse organoleptic effects
- pH is near neutral
- Stable, non-volatile, and soluble in water
Reprocessing: Approved Substances (con’t)

- **Inspexx 100**
  - Peroxyacetic acid
  - Approved as a carcass spray for on-line reprocessing (OLR)
  - Must not exceed 220 ppm
- **Spectrum**
  - Peroxyacetic acid and a proprietary substance
  - Can be used in process, scalder, and chiller water and as a carcass spray, wash, or dip
Web Sites for Most Currently Approved Substances

- Safe and Suitable Ingredients Used in the Production of Meat and Poultry Products

- Proprietary Substances
To prevent cross-contamination:

- Sanitize well
- Practice good hygiene
- Keep poultry meat below 40°F
- Consider air flow and traffic patterns
Validation

- 9 CFR 417.4
- Validation verifies the effectiveness of interventions
- Establishments must validate their intervention processes
- Acceptable validation methodologies
Campylobacter continues to be an issue in poultry processing plants.

Each plant is unique and must determine the best way to control Campylobacter in their operation.

Bio-mapping provides a way to identify critical areas where control measures should be applied.
Multiple hurdles are better at controlling *Campylobacter* than single control measures

*Campylobacter* testing should be done on a regular basis to validate that the control measures are working

Sanitation effectiveness should be monitored
Campylobacter Summary

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