

Listeria spp Surface Testing: A Useful Tool to Manage *Listeria* *monocytogenes* in Meat Products

Dr Ann Marie McNamara
Vice President, Food Safety and Scientific
Affairs
Silliker, Inc.



YOU CAN CONTROL

but not eliminate, LISTERIA IN A RTE FACILITY

- Proper design of environmental monitoring programs
- Product Formulations
- Intervention Strategies
- People practices
- Equipment design
- HACCP and prerequisite programs

Listeriosis

- 2,493 cases US annually
- 499 deaths
- High case fatality ratio: 20 deaths per 100 illnesses
- Newborns, elderly, immunocompromised, pregnant women and neonates
- Lm Suited to Food Plant Environments
- Survives/grows at refrigeration temperatures

Dawn of Zero Tolerance

- 1988 Patient complications from turkey franks
- Joint regulation of USDA, FDA, CDC
- L. mono in fully cooked, RTE products is an adulterant
- FSIS designed final product monitoring programs to detect L. mono in RTE meats
- FDA RTE products adulterated under Food, Drug and Cosmetic Act

Zero Tolerance Did Not Prevent Lm Contamination

- Control of Lm by final product testing is not effective
- Need aggressive environmental controls and monitoring programs
- Need HACCP and prerequisite programs
- Need sanitary design of equipment and facilities
- Need antimicrobials and interventions to prevent Lm or its growth

Effectiveness of Lm Control

■ Year	■ Number of Recalls
■ 2001	■ 23
■ 2002	■ 42

Control of LM in RTE Meat and Poultry Products: Final Rule

- 9CFR 430
- Effective October 2003
- Written procedures for Lm control in products exposed to the environment after cooking
- 1st mandated environmental programs
- Verify programs effectiveness through testing
- Encourages use of control measures: additives, post-pasteurization

Listeria Control in RTE Products/Environments cont'd.

- RTE product adulterated if contains Lm or contacts food contact surface (FCS) with Lm
- 3 alternatives for control established
- FSIS Directive 10,240.4

Control Requirements for LM

Requirements	Alternative 1	Alternative 2		Alternative 3
		Post-lethality treatment	Antimicrobial agent/process	
Validate effectiveness of post-lethality treatment	✓	✓		
Document effectiveness of antimicrobial agent or process	✓		✓	
Sanitation Requirements				
Testing food contact surfaces (FCS)			✓	✓
State testing frequency			✓	✓
Identify size and location of sample sites			✓	✓
Explain why testing frequency is sufficient			✓	✓
Identify conditions for Hold-and-Test, when FCS (+)			✓	✓

Control Requirements for LM

Additional Sanitation Program Requirements	Alternative 1	Alternative 2		Alternative 3
		Post-lethality treatment	Antimicrobial agent/process	
Follow-up testing to verify corrective actions are effective after 1 st FCS (+)				✓
If follow-up testing yields 2 nd FCS (+), hold products that may be contaminated until problem is corrected as shown by FCS (-) in follow-up testing				✓
Hold and test product lots for <i>L. monocytogenes</i> using sampling plan that provides statistical confidence. Release, rework or condemn products based on results. Document results and product disposition.				✓

WHY ENVIRONMENTAL SAMPLING PROGRAMS?

- Produce safe, wholesome products for our customers.
- To assure *Listeria monocytogenes* is not present in RTE products, it is imperative to reduce or eliminate *Listeria* spp. from the post-processing environment.
- Accomplished with aggressive control and environmental sampling programs supported with finished product testing as a HACCP verification tool.

DESIGN OF AN ENVIRONMENTAL SAMPLING PROGRAM

- Full knowledge of product processing and plant practices
- Choice of an Indicator Organism
- Zones and Site Selection
- Random vs Fixed Sites
- Product Contact and Non-contact Sampling
- Pre-Operational vs Operational Sampling

FULL KNOWLEDGE OF PROCESS & FACILITY

- Multi-functional team is best to design program
- In-depth knowledge of product processing
- Product Flow Chart
- Equipment List
- Plant blueprint
- Raw vs RTE cross-contamination
- Personnel duties and traffic flow

CHOICE OF AN INDICATOR ORGANISM

- **Listeria spp. found more frequently than *Listeria monocytogenes***
- **No direct public-health consequence**
- **Accepted by regulators**
- **Process control to assure effectiveness of plant programs (SSOPs, GMPs, HACCP) and to eliminate environmental niches**
- **AOAC or validated method**

DETERMINE PRODUCT ZONES & SITE SELECTIONS

- Zone: RTE post-processing area
- Each line and associated equipment must be identified

Sanitary Zones

- Zone 1 Product Contact Surfaces
 - slicers, conveyors, peelers, strip
 tables, utensils, racks, work tables

- Zone 2 Exterior of equipment; chill units;
 framework; equipment housing, floors

- Zone 3 Phones; forklifts; walls; drains

- Zone 4 Locker rooms, cafeteria, halls

Lm Monitoring Programs

- **Must be line specific**
- **5 samples per line every other week has been highly effective**
- **If positive site found: tear apart equipment, sanitize, retest (investigational testing)**
- **If site positive twice, hold and test next lot, sanitize and retest (intensified testing)**

SAMPLE TYPES

- **Product Contact**
- **Non-contact**
- **Operational: After minimum 3 hr production**

SAMPLE SITE PRIORITIES

- 1. Floors, drains, underside of mats**
- 2. Conveyor system surfaces: belt, hollow rollers, drive chains**
- 3. Peeler equipment surfaces**
- 4. Slicing equipment surfaces**
- 5. Packaging equipment surfaces**
- 6. Table / countertop surfaces**
- 7. Refrigerator / cold room interior**
- 8. Freezer interior**
- 9. Any difficult-to-clean areas along line**
- 10. Sites with food residue contamination**

FIXED VS RANDOM SITE SELECTION

- **Fixed:** Same sites monitored continuously, ex. 5 product contact sites chosen on a frankfurter line
- **Random:** As many 2' by 2' product contact sites identified per frankfurter line, 5 sites chosen randomly by computer for sampling
- Both monitor process control/effectiveness of SSOPs, GMPs, HACCP programs
- **Disadvantage of Fixed:** Known sites to be sampled and extra attention paid
- **Random Advantage:** Identifies and seeks out potential sources of contamination

METHODOLOGY

- An environmental sample shall represent the swabbing with a sterile sponge of an equivalent to a 2 ft by 2 ft area. (if the area available for sampling is less than 2' by 2', sample all of the available area).
- Sponges from an approved vendor, handled in an aseptic manner and pre-moistened with neutralizing buffer.

METHODOLOGY

- Routine product contact monitoring samples for *Listeria spp*
- Intact finished product samples analyzed for *Listeria monocytogenes*
- Method of analysis by AOAC or by a validated method



REPORTING

- Document all *Listeria* monitoring by date, zone, time, line and location.
- Document corrective actions and maintain as part of *Listeria* control records.
- The results of all sampling reported weekly to Food Safety team.

INVESTIGATE POSITIVE RESULTS

- *Listeria* flows downstream in a packaging line
- Investigate upstream also
- Map out positives
- Tear down equipment -- clean and sanitize
- Explore employee practices

Problems Observed

- Untrained laboratory personnel
- Improper sampling
- Not using neutralizing broth
- No mapping of environment
- Using percent positive results instead of investigating each positive site
- Poor equipment design

Effectiveness of Lm Control

■ Year	■ Number of Recalls
■ 2001	■ 23
■ 2002	■ 42
■ 2003	■ 13
■ 2004	■ 6
■ 2007	■ 8

FSIS Interim Rule Accomplishments

- 87% RTE plants changed manufacturing
 - 59% initiated FCS Listeria testing
 - 27% used antimicrobial ingredients
 - 17% used post-lethality treatments
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- 25% decline in percent positive FSIS Lm samples (0.75%), 2003-2004

CONCLUSIONS

- *Listeria* can be controlled, but not totally eliminated, from RTE processing environments
- An effective environmental control program should include sampling operational contact and non-contact surfaces with progressive actions toward product testing
- Comply with government regulations, but design programs which meet or exceed existing government regulations
- Goal: To produce the safest, most wholesome food for our customers

Post-Lethality Treatments

- Hot water pasteurization
- Steam pasteurization
- Radiant oven heating
- High hydrostatic pressure processing

Antimicrobial Agents

- Lactate/diacetate
- Lactic acid
- Acetic acid
- Growth inhibitor packaging (Viscase)

Process Controls

- **Substitute for antimicrobials**
- **Alternative 2**
- **Freezing**
- **Shelf-stable**
- **$A_w < 0.85 = \text{cidal}$**