Environmental Sampling: Listeria monocytogenes (Lm)

"Where's the bug?"

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Agenda

Part I. Overview and Background of Lm
Part II. Lm Sampling
Part III. Lm Outbreaks
Part IV. IVT and Rlm Testing Results

Part I. Overview and Background of Lm
What is Lm?

- Pathogenic bacteria that causes listeriosis
- Spread by water, dust, etc.
- Moisture facilitates growth, harborage, and cross-contamination
- Forms biofilms and harborage sites
- RTE: Post-processing contaminant
- Survives a wide variety of extreme conditions (heat, salt, nitrite, acidity)

Control of Lm

- Proper sanitation
- In-plant pasteurization
- Establishments should have support for the safety of incoming produce
- Workers should follow GMPs – change gloves, should not wipe their nose and touch product, etc.

How Does Lm Get Into Establishments

- HUMANS
- EQUIPMENT
- VEHICLES
- PALLETES AND SUPPLIES
- INGREDIENTS AND WATER
- HUMANS

- Once established, Listeria is nearly impossible to eradicate completely.
How does *Salmonella* get into RTE products?

- Incidence of *Salmonella* in RTE products is much lower than *Lm*
- RTE products can be contaminated with *Salmonella:*
  - Under processing
  - Ingredients added after lethality (spices, sauces) – Appendix A
  - Cross contamination – Product contact surfaces contaminated with *Salmonella*
  - Improper handling by employees
  - Insect and animal vectors

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Part II. *Lm* Sampling

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*Lm* Sampling

- Flow of people, supplies, ingredients, etc.
- Exposed product contamination
- Workers’ hands and aprons
- High contact areas (e.g., keypads, doorjambs, door handles)
- Moisture and condensation
- Areas that are difficult to clean and sanitize effectively
- Areas that may be overlooked during sanitation
There are two parts, cleaning which is the removal of debris and sanitization which is killing of microorganisms. Many establishments fail to support both parts in LTD situations. So my recommendation is to always say these two things together, perhaps even explain it.

I've never seen cracks and crevices sanitized in establishments. Crevices of equipment are washed, rinsed and sanitized, but cracks (in floors, walls etc.) are usually repaired.
**Lm Sampling: Food Contact Surface (FCS)**

- **FCS**: An area in the post-lethality processing environment that comes in direct contact with post-lethality exposed RTE product.

<table>
<thead>
<tr>
<th>FCSs</th>
<th>FCSs: Cooking and Cooling</th>
<th>FCSs: Employees</th>
<th>FCSs: Packaging</th>
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<tbody>
<tr>
<td>Tables</td>
<td></td>
<td>Uterinali: knives,</td>
<td>Low priority Storage and handling of packaging material</td>
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<tr>
<td>Conveyor Belts</td>
<td></td>
<td>tongs, thermometers</td>
<td>Film wrap</td>
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<tr>
<td>Chairs</td>
<td></td>
<td>Aprons (touches product)</td>
<td>Bags</td>
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<tr>
<td>Cutting Boards</td>
<td></td>
<td>Gloves/hands (touches product)</td>
<td>Soaker pads</td>
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<tr>
<td>Blades and hopper surfaces of slicers</td>
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<tr>
<td>Hooks and hopper surfaces of shredders</td>
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<tr>
<td>Blade and table of saws</td>
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<tr>
<td>Racks</td>
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<tr>
<td>Pans</td>
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<td>Tubs</td>
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<tr>
<td>Brine for chilling</td>
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<tr>
<td>Saws</td>
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</tbody>
</table>

**Environmental, Non-Food Contact Surface (NFCS) Sampling**

- **NFCS**: A surface that has no direct contact with exposed product.

- EIAOs may collect samples from any area FSIS RTE product is processed, held, or stored.

- Collected in other areas associated with post-lethality exposed, RTE processing.

Activity

Question: Which part is an FCS area?
Answer: Employee's gloved hands

Question: Which part is the NFCS?
Answer: The slicer handle
Environmental, Non-Food Contact Surface (NFCS) Sampling

- Wet spots on floors and walls, low places on floors where water collects, and door jambs
- Entrances where workers or equipment can track Lm
- Wheels of equipment
- Anything associated with moisture and condensation: overhead pipes, drains, squeegees, drip pans

Collect near FCSs

- Handles, switches, and control buttons
- Bottom, front and side edges of stools or chairs used by employees
- Equipment that overhangs product
- Undersides of solid conveyor belts
- Compressed air or vacuum lines
- Oven smokehouse exit areas

NFCS Sampling Sites

Part III. Lm Outbreaks
### Past Outbreak Related Positive RTE FCSs

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>RATIONALE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tray for deboned ribs</td>
<td>Extensive hand contact</td>
</tr>
<tr>
<td>Surface of portion scale</td>
<td>Extensive hand contact</td>
</tr>
<tr>
<td>Belt entering beef slicer (post op)</td>
<td>Index Sample</td>
</tr>
<tr>
<td>Top belt entering slicer (post op)</td>
<td>Index Sample</td>
</tr>
<tr>
<td>Slicer blades (post op)</td>
<td>Index Sample</td>
</tr>
<tr>
<td>Weighing bowl for sliced beef</td>
<td>Index Sample</td>
</tr>
</tbody>
</table>

### Past Outbreak Related Positive NFCs

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>RATIONALE</th>
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</thead>
<tbody>
<tr>
<td>Wet spots at floor/wall junction</td>
<td>Possible harborage</td>
</tr>
<tr>
<td>Underside of rib deboning table</td>
<td>Sanitation overlooked</td>
</tr>
<tr>
<td>Condensation</td>
<td>Possible harborage</td>
</tr>
<tr>
<td>Freezer door jamb</td>
<td>Common contact point</td>
</tr>
<tr>
<td>Electrical Switches</td>
<td>Common contact point</td>
</tr>
<tr>
<td>Drains</td>
<td>Possible harborage</td>
</tr>
<tr>
<td>Table that trays pass over</td>
<td>Sanitation overlooked</td>
</tr>
<tr>
<td>Door jamb gap between door and wall</td>
<td>Possible harborage</td>
</tr>
</tbody>
</table>

### Construction in the Plant

- **Bi Mar Foods Facility, Michigan:** 11 states, 50 illnesses, 6 deaths, 2 spontaneous abortions
  - Demolition of a refrigeration unit increased environmental contamination
  - Condensation falling from overhead pipes and the ceiling onto exposed product
  - Recalled 35 million pounds of hot dogs and deli products

- **Plantation Foods, Texas:** 10 states, 29 illnesses, 4 deaths, 3 miscarriages or stillbirths
  - Construction of the walls and floors
  - Walls harbored Lm (led to cross-contamination)
  - Recalled 16.7 million pounds of products
  - Deli turkey meat probable source of infection

*Controlling Listeria monocytogenes in Post-lethality Exposed Ready-to-Eat Meat and Poultry Products* (Construction pp. 76 – 77)
Part IV. IVT and RLM Testing Results

IVT Results (2005–2014)

- Products with the most positive results:
  - FC Multicomponent Products
  - Salads, Spreads, Pâtés
  - Other Products

FC = fully cooked
Other = individually have not come up positive often or are not sampled often

IVT Results (2005–2014)

- Products with the most positive results:
  - Other FCSs
  - Conveyors/Conveyor Belts
  - Blades, Knives
  - Why do knives test positive so often?
### IVT Results (2005–2014)

- Products with the most positive results:
  - Drains
  - Other NFCs
  - Wheels

### RL.m Results (2006–2014)

- Products with the most positive results:
  - FC Multicomponent Products
  - Other FC Products
  - Fermented Products

### RL.m Results (2006–2014)

- Products with the most positive results:
  - Other FCSs
  - Blades, Knives
  - Tables
**RLm Results (2006-July 2009)**

- Products with the most positive results:
  - Grains
  - Other NFCs
  - Wheels

**Environmental Sampling Results**

- Drains: 30%
- Other NFCs: 21%
- Wheels: 15%
- Floors: 13%
- Squeegees: 6%
- Floor Mats: 6%
- Boots, Shoes: 3%
- Walls: 2%
- Slicers: 2%
- Pallets/Pallet Jacks: 2%
- Environmental Sampling Results

**Take-Aways**

- Lm can survive a wide range of environmental conditions and thrives in moisture
- Lm is known to form biofilms
- Establishments should control sanitation
- Anything brought into the post-lethality RTE environment should be thoroughly cleaned and sanitized
- Construction in the RTE area is high risk for Listeria contamination
- Take good sampling notes that describe what was sampled and where the sample was collected

**QUESTIONS**