Controlling *Listeria* in produce facilities and packinghouses: a webinar series

Webinar 1: “FSMA and Listeria 101”
Tuesday, October 8th, 1-2 PM EST

Webinar 2: “Listeria Environmental Monitoring Programs”
Tuesday, October 15th, 1-2 PM EST

All webinar recordings and slide sets can be accessed with the following link:
https://food safety.foodscience.cornell.edu/links/control-listeria-produce/
Outline

• Part 1: Identification of risk factors
  • Where is *Listeria* likely to be?
  • Presented by Dr. Laura K. Strawn

• Part 2: Building an environmental monitoring program
  • Response to *Listeria* detection
  • Presented by Genevieve Sullivan
Acknowledgements for Part 1

- While most photos/slides are my own from years of extension work assisting the industry, a special thank you to Drs. Michelle Danyluk, Trevor Suslow, Faith Critzer and Ines Hanrahan for sharing a few others.
Quick *Listeria* Recap

- *Listeria* can be isolated from diverse sources including soil, water, animals, employee shoes, ATMs, etc.

- *Listeria* can
  - multiply over a range of temperatures
  - adapt to a variety of stressors
  - persist for long periods in environments

- *L. monocytogenes* is the *Listeria* species capable of causing foodborne illness in humans; and has been the cause of many produce product recalls
Identification of risk factors

- Likelihood of harborage

- Likelihood of cross-contamination (transfer)
Diverse Spectrum of Facilities/Packinghouses
Risk Factor: Outside environment

• Contamination from the outside environment (including the pre-harvest production environment) is likely to be low, but expect *Listeria* to be present sporadically, and potentially transferred

• Challenge to exclude potential harborage sites
Risk Factor: Building/building design basic elements

- Cracked and broken epoxy floor coatings
- Degraded concrete with areas of exposed aggregate
- Holes/openings to the outside environment
- Floors that aren’t sloped towards drains, solid, or cleanable
- Cooler condensate does not drain to floor, onto product or contact surfaces
- Poor drainage (or no drainage)
- Harborage areas on door thresholds
- Sanitary joint between floors and walls
Risk Factor: Drains

• Whether you ask experts, google, or read the literature… drains are a common *Listeria* harborage site

• Prevent cross-contamination from drains to other areas
  • Avoid pressurized washer to clean drains
  • Designated brush for drain
  • Management plan/SOP to minimize clogged, or backed up drains

• Keep *Listeria* out of drains: sanitation!
  • Rotate sanitizers
  • Clean/sanitize frequently (based on operation size, volume of product, etc.)
Risk Factor: Equipment/equipment design basic elements

- Cleanability
- Modifications (exposed screws as fasteners, Teflon tape, duct tape, welds, etc.)
- Entrapment of debris (cracked belts, frayed/exposed edges)
- Dead-legs from wash systems/flumes
- Long-term exposure to sanitizers (how does equipment hold-up)
Risk Factor: Poor/rough welds

- May be source of entrapment points
Risk Factor: Pre-coolers and cold storage rooms

- Not always built with cleaning/sanitizing in mind
- Cold and or wet environment - *Listeria* friendly
- Pests (insects, birds, rodents – vectors)
- Storage bins and fork-lifts may bring potential contamination into the environment
- Air handling system may spread contamination around
- Cooling coils hard to clean
- Spray on insulation
- Damage from fork-lifts/water
Risk Factor: Condensation/Pooled Water

• Dripping condensation in coolers

• Condensation on cold-curtains/floors/etc.

• Pooling of water; run-off from bin-dumps, flumes, other sources
Risk Factor: Product flow

Preferences for Product flow directions (from Troller, Sanitation in Food Processing)
Risk Factor: Tools, equipment, and items that move

• Not an exhaustive list… fork-lifts, bins, squeegees, brushes, mops, fans, floor mats, chairs, tables, trash cans, brooms, carts, various tools, boxes, pallets, etc.

• Especially tools, equipment, and items that move between the outside and inside
Risk Factor: Hollow items

• Difficult to clean and sanitize

• Allow potential build up of organic matter

• Retain moisture
Risk Factor: Employees

• Lack of employee training on routes of cross-contamination

• Things happen when you aren’t watching (it is important for employees to understand basic food safety, and *Listeria* concerns)
Wrap Up

• *Listeria* control can be challenging
  • Lots of unique operations/surrounding environments

• However, there are several steps a facility/packinghouse may take to minimize *Listeria*
  • Map out facility/packinghouse and flow of product to assess your operation’s vulnerability to *Listeria*
    • For example, do you have hollow items, or equipment/tools that move between inside and outside of the facility/packinghouse? Areas prone to pooling of water?
  • Implement and or refine sanitation SOPs
  • Develop an environmental monitoring program (part 2)
Building an effective environmental monitoring program

Genevieve Sullivan
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GUIDANCE ON ENVIRONMENTAL MONITORING AND CONTROL OF LISTERIA FOR THE FRESH PRODUCE INDUSTRY

Second Edition

Developed by the United Fresh Food Safety & Technology Council
STRATEGIES FOR LISTERIA CONTROL IN TREE FRUIT PACKINGHOUSES

First Edition
Contains Nonbinding Recommendations

Control of *Listeria monocytogenes* in Ready-To-Eat Foods: Guidance for Industry

*Draft Guidance*

This guidance is being distributed for comment purposes only.
OUTLINE

• Goals of an EMP
• Identifying testing zones
• Where to sample (where not to sample)
• What to test for: *Listeria* spp. vs. *L. monocytogenes*
• Master swab plan
• How to collect samples
• Selection of a lab to do the testing
• Response to *Listeria* detection (or lack thereof)
GOALS OF AN EMP

1. Verify the effectiveness of your control programs for *L. monocytogenes*

2. Find *L. monocytogenes* harborage sites if present in your plant

3. Ensure that corrective actions have addressed *L. monocytogenes* harborage sites when found in your plant.
An environmental monitoring and control program is not intended to prevent the presence of transient *Listeria*. 
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**Transient**: a one-time isolate whose repeated presence via swabbing is not detected.

**Resident/Persistent**: (“pet”) an isolate that is repeatedly found, indicating a potential lapse in GMPs or existence of an undiscovered niche which has allowed for a harborage site to be established.
## GOALS OF AN EMP: TRANSIENT VS. PERSISTENT

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IDENTIFYING TESTING ZONES
ZONE 1
Food Contact Surfaces
(Slicers, peelers, fillers, hoppers, screens, conveyor belts, air blowers, employee hands, knives, racks, work tables)

ZONE 2
Non-Food Contact Surfaces in Close Proximity to Food and Food Contact Surfaces
(Processing equipment exterior and framework, refrigeration units, equipment control panels, switches)

ZONE 3
More Remote Non-Food Contact Surfaces Located In or Near the Processing Areas
(Forklifts, hand trucks, carts, wheels, air return covers, hoses, walls, floors, drains)

ZONE 4
Non-Food Contact Surfaces Outside of the Processing Areas
(Locker rooms, cafeterias, entry/access ways, loading bays, finished product storage areas, maintenance areas)
IDENTIFYING TESTING ZONES

• Focus on zones 2 and 3.

• Zone 4 is good for fresh-cut. Doesn't have much meaning for packinghouses.

• Zone 1 – requires thoughtful preparation.
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Zone 1 – requires thoughtful preparation.

https://www2.unitedfresh.org/forms/store/ProductFormPublic/Zone-1-Testing-webinar
SAMPLING LOCATIONS

• Wet, relatively undisturbed areas

• Areas that may trap organic material and are difficult to access (e.g. weld seams, metal cracks, brushes, rollers and along threads of bolts)

• Overlapped materials such as ultra-high-molecular-weight polyethylene (UHMW) bolted to stainless steel
SAMPLING LOCATIONS

- Drains
- Cracked floors
- Fatigue mats and no-slip runners
- Damaged bins/totes or pallets
- Cooling units
- Drip pans
- Condensate on walls or ceilings
- Difficult-to-access or difficult-to-clean pieces of equipment
- Sorting equipment
- Motor or control housings
- Flume covers
- Bearings
- Pallet jacks
- Forklifts
- Under bumper guards and bumper post sleeves at loading docks
WHERE TO SAMPLE (PACKINGHOUSES)

- Drains
- Dump tank area
- Areas with wax build-up
- Overhead doors
- Fork lifts
- Fork lift stops (floor sandwich juncture)
- Steps/ladders/stands
- Floor cracks/holes
- Squeegees
- Catch pans
- Loading docks
- Boots
WHERE TO SAMPLE (WHERE NOT TO SAMPLE)

Think about:

• Corrective actions (if it’s positive, what can you do?)
• Likelihood of being positive
• Likelihood of contaminating product
WHAT TO TEST FOR: LISTERIA SPP. VS. L. MONOCYTGENES

• If *Listeria* spp. can become entrenched in a niche, so can *L. monocytogenes*
• Test results for *Listeria* spp. are generally available more quickly than for *L. monocytogenes*
  • The issue is that you may get too many positives to appropriately react to all of them
• A program based on *Listeria* spp. detection is more conservative
• If *Listeria* spp. treated as though they were *L. monocytogenes*, little reason to take tests to species confirmation.
WHAT TO TEST FOR:
LISTERIA SPP. VS. L. MONOCYTOGENES

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67% of *Listeria* positive samples contain LM
**Frequency?**

- Packinghouses: Monthly (quarterly at least)
- Fresh-cut: Weekly
MASTER SWAB PLAN

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Quantity? More or less depending on size of facility, end use, prior trending, etc.
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**Composites?** Up to five, but go low risk to high risk.
HOW TO COLLECT SAMPLES:
HYDRATED SPONGE
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~$5 for the swab itself. To have it tested, $20-35.
HOW TO COLLECT SAMPLES: HYGIENA INSITE
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IB003 Small Block Incubator – 12 hole – retail price is $90.00

50/box – retail price is $360.50/box

100/box – retail price is $618.00/box
HOW TO COLLECT SAMPLES: 3M MDS
HOW TO COLLECT SAMPLES

• Pre-label all Listeria sampling bags with specific site test number
• Wear clean clothes, wash hands, wear clean boots/foot cover and hair nets.
• Keep sampling sheets and site map close to record any changes in equipment location while swabbing.
• Remove gloves from pouch one at a time, touching only the top tab of the bag.
• Holding bag with sponge at top, remove seal and open bag. Remove sponge with gloved hand.
• Swab site with corresponding sampling area to label on bag.
• Place used/completed sampling bags in cooler. They should remain at 4 degrees C or less until processed by the testing laboratory. Ship as soon as possible.
ISO accredited labs (or comparable entities like AFNOR) with AOAC approved methods.

Examples:

- Microbac $26-$35 range, depending on specificity (cheaper for genus, more expensive for species)
- Chestnut Labs
- EMSL Analytical (VIDAS)
- Merieux NutriSciences
- PrimusLabs
- Biotrax – Cheektowaga, NY
- Eurofins – Lancaster, PA
- Deibel – Bethlehem, PA
- Certified Labs – Melville, NY
- Other labs nationwide (most cover shipping)
Examine the site and investigate potential causes.

- How likely is it that a detection at this site is a transient Listeria?
- Has Listeria been detected in or around this site before?
- In which Zone was the Listeria detected?
Pre-operational sites in pilot plant area swabbed each month for *Listeria* spp.

- **Positive**
  - Evaluate site for possible contamination host(s). Make notes of possible host(s). Note modifications made, if any. Focused cleaning & sanitizing at positive site. Resample pre-operational after cleaning.

- **Negative**
  - Add Notes to final report of investigation and any action taken.

  - **Positive**
    - Perform extra cleaning and conc. sanitizing. Retest after confirmation with plant manager that proper clean-up has been achieved. Identify and record five (5) vector sites either as starburst or traffic pattern (depending on site parameters). Sample additional sites pre-operational.

  - **Negative**
    - Drop additional site from monthly testing. Make report of findings. Audit area as necessary.

  - 2 consecutive monthly Negative samples

Create an isolation area at positive site. Cease use of area. Consult with chemical company for recommendations. Follow further cleaning instructions. **Add additional site from contamination query to consecutive monthly testing**
• Additional samples should be collected at the site and adjoining areas as soon as possible.

• If a positive was initially detected in a composited sample, individually sample each of the sites that made up that composite and test individually to help hone in on the source of contamination.
Vector Swabs:
• Multiple samples taken around the initial positive site
• All directions
• Areas that may have to led to that site being positive.
RESPONSE TO LISTERIA DETECTION
(OR LACK THEREOF)

• Review testing results every time results are reported
  • This should include review of at least last 4-8 sampling results to identify trends (e.g., site that has positives with intervening negatives)
  • Take corrections on each positive sample and document action
• Organize testing results in one location (folder, three-ring binder or ideally electronically)
  • Include documentation of corrections in same location
• Conduct regular (quarterly, yearly; depends on testing frequency & volume) review of testing results
  • Tabulate and evaluate long-term trends
RESPONSE TO _LISTERIA_ DETECTION (OR LACK THEREOF)

Corrective actions must go beyond “deep cleaning” and may include:

- Cleaning and sanitation procedures and SSOPs may need to be changed
- Maintenance may be needed and preventive maintenance program may need to be improved
- Equipment may have to be modified and replaced
- Problem areas may have to be shut down temporarily
The packinghouse/facility environment is an important source of foodborne pathogens

- Environmental sources are a particular concern for *Listeria monocytogenes*

**TAKE HOME MESSAGES**

The packinghouse/facility environment is an important source of foodborne pathogens

- Environmental sources are a particular concern for *Listeria monocytogenes*
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Good pathogen environmental monitoring programs are set up to find pathogens, not to show that there are no problems

- If it’s there and you don’t find it, FDA will
- Increasing trend towards a requirement for pathogen environmental monitoring programs for any ready-to-eat foods that are exposed to the environment
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Sampling will not control food safety hazards, the actions taken after positive results will

- Positive results need to be followed up with root cause analysis
- Results need to be used for immediate corrective actions as well as long term improvements (equipment design etc.)
Questions?

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