

# **Practical Control of *Listeria monocytogenes* in RTE Foods**

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# Listeriosis in the US

☞ **2500 cases**

➤ **Campylobacteriosis – 2.5 million cases**

➤ **Salmonellosis – 1.4 million cases**

☞ **500 deaths (20%)**

**CDC, 1999**



# Listeriosis Outbreaks

- ➔ **Coleslaw, Nova Scotia 1981**
- ➔ **Mexican-style cheese, CA 1985**
- ➔ **Soft cheese, Switzerland 1983-87**
- ➔ **Pâté, England 1987-89**
- ➔ **Hot dogs, US 1998-99**
- ➔ **Vegetables, seafoods, pork tongues, butter**

# FDA Recalls

- 17 in 1999, 34 in 2000, 28 in 2001
- sandwiches, cheeses (hard and soft), sliced apples, platter w/ red bell peppers, seafood (smoked, salads, dip), ice cream, cut salads, sprouts, coleslaw, hummus

9/15

# USDA Recalls

- 31/62 (50%) in 1999; 35/76 (46%) in 2000; 14/55 (25%) in 2001
- sausages, chicken nuggets, hot dogs, roast beef, corned beef, ham, bologna, enchiladas, burritos, fajitas, chicken salad, chicken wings, roast duckling, duck breast, jerky

9/15

# Canadian Recalls – August 2001

- ➔ Mitchell's Gourmet Foods,  
Saskatoon: Wieners
- ➔ JM Schneider, Kitchener: sliced  
luncheon meats
- ➔ Golden Valley Farms, Arthur, Ont.:  
Fletcher's smoked chicken and  
smoked turkey breast

# *Listeria monocytogenes*

- ➔ **Non-sporeforming, Gram-positive rod**
- ➔ **Grows aerobically and anaerobically**
- ➔ **Grows between -0.4 and 50°C**
- ➔ **Grows at pH 4.4 to 9.6**
- ➔ **Grows at 10% NaCl**

# *Listeria monocytogenes*

- ➔ **Withstands repeated freezing and thawing**
- ➔ **Survives for prolonged periods in dry conditions**

# *L. monocytogenes* is widespread in the environment.

- ➔ Soil
- ➔ Water
- ➔ Sewage
- ➔ Decaying vegetation

# ***L. monocytogenes* is widespread in the environment.**

- **Domestic animals (including pets)**
- **~5% of the normal population**
- **Raw agricultural commodities**
- **Food processing environments**
- **The home**

# ***Lm* is found in a wide variety of foods.**

- ➔ **Meats**
- ➔ **Poultry**
- ➔ **Vegetables**
- ➔ **Dairy products**
- ➔ **Fishery products**

# *Lm* is unique

- ➔ **Grows (slowly) at refrigeration temperatures**
- ➔ **Difficult to inactivate**
- ➔ **Ubiquitous**

# *Lm* Contamination

- ➔ Control can reduce the frequency and level of *Lm* contamination
- ➔ *Lm* contamination cannot be fully eliminated from all products

# Consequences of *Lm* in Foods

## ☞ Listeriosis

- normal individuals????
- pregnant women
- neonates
- the elderly
- immunosuppressed individuals

# “Factoids”

- ☞ *L. monocytogenes* is common.
- ☞ Listeriosis is rare.
- ☞ Implicated foods (outbreaks and sporadic cases) limited to a few refrigerated products that can support growth.

# *Lm* Policy - US

☞ **“Zero tolerance” in all  
ready-to-eat (RTE) foods**

**(absence in 25 g sample)**

# *Lm* Policy - Canada

(1) RTE foods linked to listeriosis

0/50g

(2) RTE foods, support growth,

0/25g

SL>10 days

(3) RTE foods, SL<10days or RTE

<100/g



# **GUIDELINES TO PREVENT POST- PROCESSING CONTAMINATION FROM *LISTERIA MONOCYTOGENES***

**R.B. Tompkin, V.N. Scott, D.T.  
Bernard, W.H. Sveum, K.S.  
Gombas**

***Dairy, Food and  
Environmental Sanitation 19:  
551-562. 1999***



# Control of *L. monocytogenes*

- ➔ Recontamination can come from many sources
- ➔ Control of recontamination through HACCP CCPs is impractical
- ➔ Prerequisite programs are the foundation for *Lm* control

# Control of *L. monocytogenes*

- ☞ Management commitment
- ☞ Training on *Lm* control
  - sources of *Listeria*
  - methods used for control
  - individual responsibility
- ☞ Validated processes

# “Bulls Eye” Approach to Control

## Direct Product Contact

- ➔ Filling or packaging equipment
- ➔ Collators
- ➔ Conveyors
- ➔ Racks
- ➔ Chilling solutions
- ➔ Hand tools
- ➔ Slicers, dicers, shredders, blenders (after heating, before
- ➔ apparel
- ➔ Spiral/blast freezers
- ➔ Bins, tubs, or baskets

# Secondary Level of Concern, Indirect Product Contamination

➔ Equipment framework and other equipment in the area

➔ Floors

➔ Drains

➔ Walls and ceilings, especially if cracked

➔ Overhead structures, catwalks

➔ Condensate

➔ Insulation in walls or around pipes

➔ Walkways

➔ Cleaning tools

➔ Maintenance tools



# Tertiary Level; Recontamination of Processing Area

- ☞ Traffic in the processing and packaging areas
  - people
  - equipment such as trolleys and forklifts
- ☞ Unscheduled equipment maintenance

# Niches, the Dark Holes of *Lm* Control

- ➔ Hollow conveyor rollers
- ➔ Slicers, dicers
- ➔ On/off switches
- ➔ Rubber seals around doors
- ➔ Damp insulation
- ➔ Fibrous or porous conveyor belts
- ➔ Conveyor scrapers, especially if in poor condition
- ➔ Open bearings in equipment

# More Niches

- ➔ **Hollow implements, including box cutters**
- ➔ **Trash cans and other ancillary items**
- ➔ **Standing water in production areas**
- ➔ **Cleaning tools, including mops**
- ➔ **In-line air filters for compressed air**
- ➔ **Wet, rusting or hollow framework**
- ➔ **Motor housings**
- ➔ **Walls/crevices of spiral freezers;**
- ➔ **Ice makers**

# *Lm* Control in Niches

Good control involves identifying the source or niche of the *Listeria* contamination and eliminating it.



# Some Conditions That Have Caused Problems

- Moving or significantly modifying a packaging line
- Installing used equipment brought from storage or another plant
- Equipment breakdown

# More “Red Flag” Situations

- Construction or major modifications in an RTE area.
- A new employee, unfamiliar with the operation and *L. monocytogenes* controls in the RTE product area.

# More “Red Flag” Situations

- ➔ **Frequent product changes on a packaging line.**
- ➔ **Personnel are used interchangeably for packaging raw and cooked products.**

# General Considerations: Processing

## Prevent Cross Contamination

- ➔ **Separate raw products from semi-finished and finished products**
  - **linear product flow**
  - **control people flow**
  - **positive air flow on the “clean” side**

# General Considerations: Processing

## Compartmentalize

- Provide dedicated washing areas for cooked product equipment and raw processing equipment.
- Rework and trash barrels
  - color coded
  - not used interchangeably in plant

# General Considerations: Processing

## Compartmentalize Operations

- ☞ Have separate utensils, carts, racks, totes, equipment, cleaning utensils, etc. (color coded where practical) for the RTE area.

# General Considerations: Processing

## Compartmentalize Operations

Where possible:

- ❖ Eliminate overhead fixtures in the RTE area
- ❖ Isolate wet process areas from other production areas
- ❖ Remove standing water quickly

# General Considerations: Processing

## Control Traffic Flow

- ➔ Do not interchange equipment, utensils, and people in raw and cooked areas
- ➔ Consider footbaths or spraying foam disinfectant as people/equipment enter the room

# General Considerations: Equipment

- Design equipment to facilitate cleaning
- Previously used equipment may harbor pathogens
- Properly maintain equipment to minimize breakdowns and risk of contamination during repair

# General Considerations: Equipment

- ➔ Repair or replace damaged, pitted, corroded, or cracked equipment
- ➔ Equipment/catwalk framework should not be hollow
- ➔ Lubricants contaminated with product residue can become niche for *Lm* - use listericidal additives

# General Considerations: Equipment

- **Avoid conveyor designs and locations difficult to clean and sanitize**
  - **no hollow rollers**
  - **do not locate near floor (source of contamination)**
  - **avoid overhead conveyors (difficult to clean and sanitize)**

# General Considerations: Equipment

- ☞ Racks should have cover guards over wheels to prevent spray onto product
- ☞ Racks may need to be heat sanitized
  - 180°F water
  - steam cabinet
  - oven
  - so racks reach 160°F

# General Considerations: Equipment

## ☞ Maintenance

- adopt regular schedules to minimize potential for harborages
- in RTE area may need tools dedicated to this area or sanitized prior to use in area

# General Plant Sanitation

- Use sanitation procedures designed to control *Lm*
- Control of *Lm* requires consistency and attention to detail - some equipment may require disassembly



# General Plant Sanitation

- ➔ Cleanup crew should receive special training
- ➔ Priority must be given to rooms/equipment where RTE product is exposed

# General Plant Sanitation

- **Eliminate mid-shift cleanups**
- **Rotate sanitizers for effectiveness**
- **Modify equipment - simple in design, easy to clean, fewer maintenance problems**



# General Plant Sanitation

- ➔ **Stacking plastic tubs can be a problem - clean and sanitize daily**
- ➔ **Coolers should be emptied and cleaned weekly**
- ➔ **Spiral freezers should be cleaned twice a year**

# General Plant Sanitation

- ➔ **Condensate in drip pans should be directed to drains via hoses**
- ➔ **Solid sanitizer (blocks, donuts) should be used in drip pans**
- ➔ **Drip pans should be cleaned regularly**

# General Plant Sanitation

- ☞ **Floor drains:**
  - **design and maintain to prevent backups**
  - **eliminate trench drains**
  - **use bactericidal drain rings**
  - **clean drains in manner to prevent splashing; use dedicated utensils**

# General Plant Sanitation

- ☞ **Cleaning tools:**
  - **sanitize using 600-1000 ppm quat**
  - **store dry or**
  - **store in quat solutions maintained at 1000 ppm**

# Personnel Hygiene

- ➔ **Gloves, smocks, aprons are essential to protect against product contamination, not to keep employee clean**
- ➔ **If an unclean surface is touched, wash hands/change gloves**

# Personnel Hygiene

- ➔ In the packaging room assign a person not working on the line to pick up material from floor, remove trash, etc.

# Environmental Monitoring Program

- ➔ Verifies the *Lm* control program
- ➔ Used to assess the need for additional pathogen control measures
- ➔ Must be ongoing, since entry of *Listeria* cannot be prevented

# Environmental Monitoring Program

## General Principles

- ➔ **Emphasis here is on testing for *Listeria*-like organisms in the environment to verify control. There are many variations on how this can be done.**

# Environmental Monitoring Program

## General Principles

- ➔ **Monitoring results should alert plant to potential problem areas, prompting investigation and correction**

# Environmental Monitoring Program

## General Principles

- ☞ *Lm* is not found frequently in products in plants following good *Lm* control guidelines, therefore product testing is not a reliable indicator that *Lm* contamination did not occur.

# Environmental Monitoring Program

## Environmental Testing

- ➔ Determine points to sample and frequency based on knowledge of operation, controls and micro data.
- ➔ Suggested areas: support structures, overhead structures, walls, floors, drains.

# Environmental Monitoring Program

## Environmental

## Testing

- ➔ Sample weekly, at least initially.
- ➔ Track results and identify need to take action.
- ➔ Determine action to take when *Listeria* spp. positives exceed upper control limit.

# Environmental Monitoring Program

## Environmental Testing

- ➔ **Detection of *Listeria* spp. does not necessarily indicate a microbiological control problem; it indicates the need for additional investigation**

# Environmental Monitoring Program

## Environmental Testing

- ➔ If trend is toward an increased incidence of *Listeria* spp., plants should investigate to determine the reason and take action to reduce the level.

# Environmental Monitoring Program

## Environmental Testing

- ➔ If positive sample was a composite, individual samples should be tested to pinpoint the location of the positive.
- ➔ Additional samples should be taken from positive

# Environmental Monitoring Program

## Environmental Testing

- ➔ If, after corrective actions, there are additional positives, the environment should be intensively cleaned and re-tested.
- ➔ Consider the need to sample food contact surfaces in positive areas.



# Environmental Monitoring Program

## Food Contact Surface Testing

- ➔ Food contact surfaces may be tested routinely or only when environmental monitoring suggests a problem.

# Environmental Monitoring Program

## Food Contact Surface Testing

- ➔ Determine points to sample and frequency based on knowledge of operation, controls and micro data.

# Environmental Monitoring Program

## Food Contact Surface

### Testing

- ➔ Investigate to determine reason for all positives on food contact surfaces.
- ➔ Corrective actions should be pre-determined and documented.

# Environmental Monitoring Program

## Food Contact Surface

### Testing

#### ☞ Corrective actions:

- modify cleaning and sanitizing procedures
- re-design equipment
- improve GMPs

# Environmental Monitoring Program

## Food Contact Surface

### Testing

- ➔ Consider whether the finding of *Listeria*-like organisms on food contact surfaces should result in the need for product testing.

# Product Testing

- ➔ Product may be tested as a result of positive food contact surfaces.
- ➔ Random product testing may be used to verify that the *Lm* control/monitoring program is effective in preventing product contamination.

# Product Testing

☞ **ALL SAMPLED LOTS  
SHOULD BE HELD UNTIL  
THE LABORATORY  
RESULTS ARE  
AVAILABLE!**



# Product Testing

- ☞ **Plants must determine the actions to be taken in the event that *Lm* is detected in a product sample.**

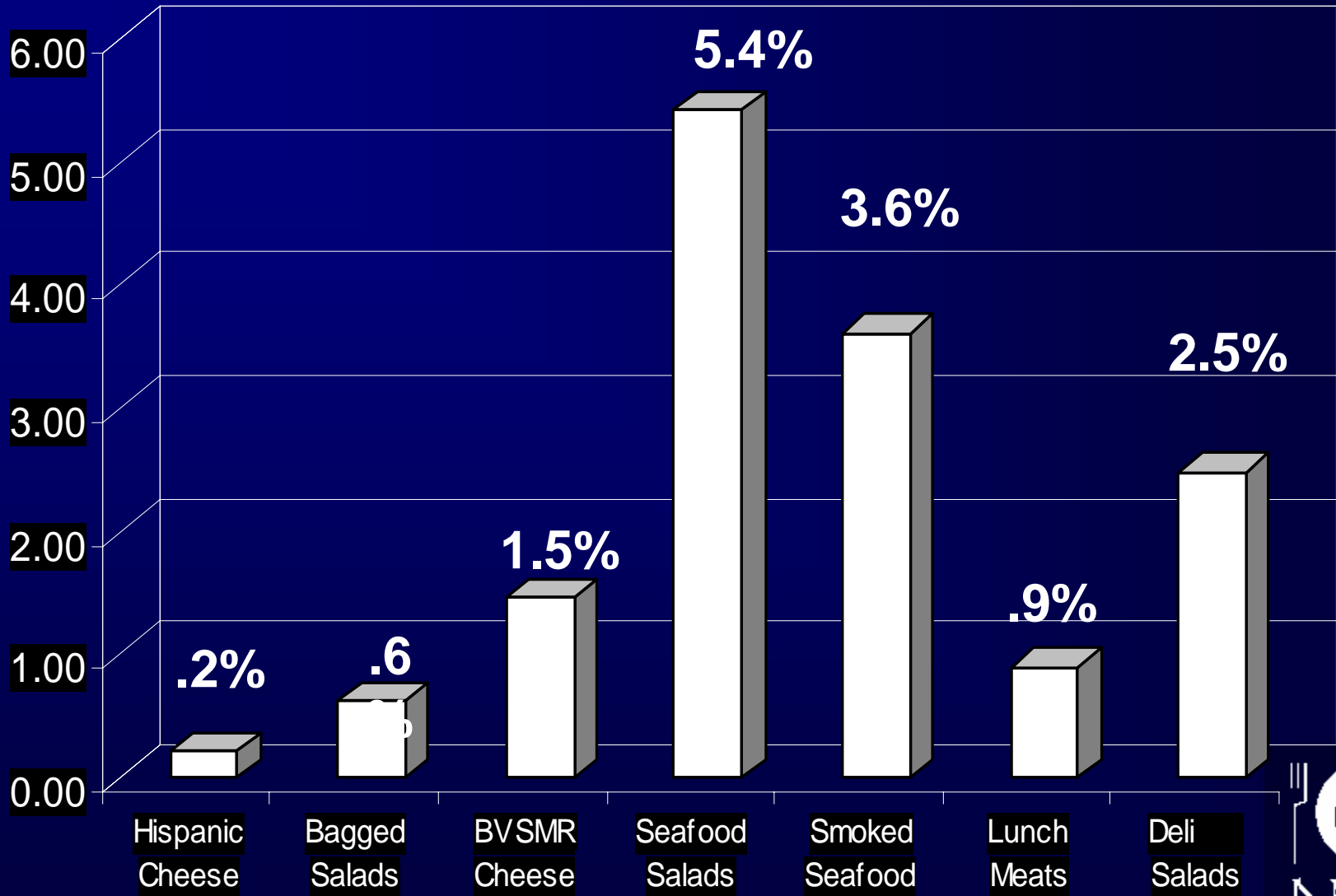
**But does this  
work?**

# Industry Progress: *Lm* Control

<u>Product</u>	<u>year</u>	<u>%</u>
<u>positive</u>		
Lunch meats	1990	7.7
	1999	4.6
Hot dogs	1990	4.2
	1999	1.8
Salads/spreads	1990	5.5
	1999	1.2

Levine et al. 2001. J. Food Protect. 64:1188-1193





**NFPA RF**



# *Lm* Control at Retail

<u>Product</u>	<u>pkg</u>	<u>% positive</u>
Lunch meats	Mfr.	0.4
	retail	2.5
Deli salads	Mfr.	1.3
	Retail	3.4
Seafood salads	Mfr.	1.8
	Retail	7.8

NFPA Research Foundation, 2001



**“...it’s clear we must do more to protect Americans from this deadly pathogen. So today, I’m directing the Departments of Ag. And HHS to prepare an aggressive new strategy to significantly reduce the risk of illness from *Listeria*.”**

**William J. Clinton**

**May 6, 2000**



# Thanks