



**PMA Produce Safety Policy Conference
Listeria monocytogenes Produce Safety Policy
Issue Brief**

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PMA has identified “*Listeria monocytogenes* (Lm) produce safety policy” as a key industry issue, and it is providing value to its membership by:

- 1) Development of Sound Science:** advocating for and financially supporting development of science and risk-based solutions via CPS, and other means, to drive sound public policy and practical preventive control solutions to address the public health risk posed by Lm in or on fresh produce.
- 2) Advocating for Sound Public Health and Regulatory Policy:** advocating for sound, practical public health and regulatory policy based on sound science.
- 3) Working in Partnership** with allied produce trade organizations, government and academia to provide the produce industry with the means to effectively address the public health risk posed by Lm in or on fresh produce, irrespective of where they are in the supply chain or located in the world.

Meeting Objectives

The goals of this meeting are to foster science- and risk-based produce safety policy discussion and build consensus on key produce policy issues among produce industry policy thought leaders and government policy makers. A specific objective of the Lm produce safety policy portion of this conference is to discuss and develop possible recommendations regarding FDA policy and industry best practices which address the public health risk of listeriosis from raw agricultural commodities, with particular emphasis on produce packed in packinghouses. Other objectives include:

- 1) Understanding current FDA policy regarding Lm.
- 2) Understanding lessons learned from Lm associated produce foodborne illness outbreaks and recalls.
- 3) Identifying knowledge gaps regarding Lm and produce.
- 4) Identifying preventive controls and verification activity that can be implemented by industry to reduce the public health risk posed by Lm in or on fresh produce.
- 5) Developing a roadmap for development of science- and risk-based public health policy that practicably addresses the public health risk posed by Lm in or on fresh produce.

Background

In recent years there have been a number of high profile foodborne illness outbreaks and product recalls due to Lm contamination of fresh produce (see details below regarding outbreaks and recalls). These produce associated Lm foodborne illness outbreaks and recalls have brought to the forefront many uncertainties regarding the public health risks associated with Lm and fresh produce such as Lm prevalence rates, Lm contamination levels and Lm growth rates on fresh produce. These incidents will likely increase the frequency of testing fresh produce items by individual companies and regulatory agencies, and the use of whole genome sequencing, “case matching” to contaminated food items will likely lead to an increased frequency of reported outbreaks of listeriosis linked to fresh produce items. However, it will not be clear if increased testing alone or an actual change in the risks associated with fresh produce consumption has occurred.

The public health burden of listeriosis has historically been associated with infrequent occurrence in food items contaminated with relatively high levels of Lm. However, the recent reported deaths associated with consumption of Blue Bell ice cream are of particular concern in that low levels of Lm were reported in frozen ice cream which is considered an Lm non-growth food during frozen storage conditions.

Historically, particular attention has been given to persistent populations of Lm in food processing plant environments that may lead to high levels of contamination of food products. However, most fresh produce contamination likely results from occasional transient contamination of raw agricultural commodities from natural environments in low numbers. This type of contamination may or may not represent an elevated public health risk. The challenge for the produce industry and regulatory agencies is to distinguish between intermittent, low-level contamination and persistent environmental contamination of processing environments that may result in substantial numbers of illnesses. Preventive control strategies that focus on identifying and controlling persistent sources of environmental Lm contamination are likely to maximize public health outcomes by preventing disease without frequently alarming the public about the safety of fresh produce.

Facts Regarding *Listeria monocytogenes*

Excerpted: FDA Bad Bug Book Foodborne Pathogenic Microorganisms & Natural Toxins, 2012 and other cited sources.

<http://www.fda.gov/Food/FoodborneIllnessContaminants/CausesOfIllnessBadBugBook/>

1. The Organism

Lm is a Gram-positive, rod-shaped, facultative bacterium, motile by means of flagella, that is among the leading causes of death from foodborne illness.

- **Serotypes:** Lm has 13 serotypes, including 1/2a, 1/2b, 1/2c, 3a, 3b, 3c, 4a, 4ab, 4b, 4c, 4d, 4e, and 7. Among them, serotypes 1/2a, 1/2b, and 4b have been associated with the vast majority of foodborne infections.
- **Lm is hardy**
 - Salt-tolerant
 - Can survive at temperatures below 1°C
 - Can grow at low temperature, unlike many other pathogens
 - Known to persistence in food-manufacturing environments
 - Commonly found in the environment particularly in moist environments, soil, and decaying vegetation
- **Other non-pathogenic *Listeria* species:** *L. grayi*, *L. innocua*, *L. ivanovii*, *L. seeligeri* and *L. welshimer*

2. Listeriosis the Disease

- **Mortality:** Listeriosis and complication from listeriosis are among the leading causes of death from foodborne illness, with the severe invasive form of the infection having a case-fatality rate of 15% to 30%.
- **Two Forms of the Disease & Onset**
 - **Non-invasive gastrointestinal illness:** mild to intense symptoms of nausea, vomiting, aches, fever, and, sometimes, diarrhea with an illness onset of a few hours to 2-3 days. Generally self-resolves in otherwise healthy people.
 - **Invasive form of the illness:** caused by infection spreading through the bloodstream to the nervous system (including the brain), resulting in meningitis and other potentially fatal problems. Pregnant women, fetus, persons with weak immune systems, (for example, those with AIDS or chronic diseases, or who are on certain immune suppressing arthritis drugs or cancer chemotherapy) and the elderly are especially vulnerable. This illness form can have a very long incubation period, estimated to vary from 3 days to 3 months.
- **Infective Dose:**
 - The infective dose of Lm is undetermined, may vary widely and depends on a variety of factors.
 - Believed to vary with the strain and susceptibility of the host and the food involved. For example, in cases associated with raw or inadequately pasteurized milk it is likely that fewer than 1,000 cells may cause disease in susceptible individuals.
 - Pouillot et al, 2014 demonstrated through recent risk modeling analysis that: *“while most of the cases are linked to a medium and high exposure doses to Lm, those at greatest risk of developing listeriosis are also at a measurable risk of illness when consuming food contaminated with relatively low doses of Lm especially if highly virulent bacterial strains are involved.”*

3. Agricultural Prevalence:

- Chapin et al, 2014 reported that the prevalence of *Listeria species*, was found in approximately 33% of samples obtained from the natural environment (n= 734) and 34% of the time in samples obtained from produce production environs (n=734) in New York State. These data show that *Listeria species* were prevalent in both agricultural and non-agricultural environments.
- Strawn et al, 2013 reported that over 5 weeks when 21 farms in New York State were sampled, Lm was found in 17.5% of produce field soils or drag swab samples (n=263) and 30% of water samples (n=74). However, the majority of pathogen positive water samples were from non-irrigation surface water sources.

4. Research Needs (from Ferreira et al, 2014)

- Are certain Lm traits critical for or contribute to persistence?
- Are specific Lm subtypes that are specifically associated with food and nonfood micro- or macro-environments (e.g., a geographical region) or animal populations?
- What factors affect persistence of Lm food-associated environments and transfer of persistent strains to foods?
- Are quantitative approaches needed to define when re-isolation of a specific Lm subtype reflects true persistence or is it just a random re-isolation of a common subtype?

Produce Associated U.S. Lm Foodborne Illness Outbreaks and Recalls (Facts & Figures)

2011: Cantaloupes from Colorado

- 146 persons in 28 states infected
- 5 Lm outbreak strains
- 33 deaths and one miscarriage
- Deadliest foodborne disease outbreak in the United States in nearly 90 years
- 1st Lm outbreak associated with fresh whole cantaloupe
- Lm previously considered a fresh-cut issue
- Potential Contributing Factors: Facility sanitary design, Equipment sanitary design, Postharvest practices
- Source: FDA Environmental Assessment: Factors Potentially Contributing to the Contamination of Fresh Whole Cantaloupe Implicated in a Multi-State Outbreak of Listeriosis (October 19, 2011)
<http://www.fda.gov/Food/FoodSafety/Foodbornellness/ucm276247.htm>

2014: Stone Fruit from a California Packinghouse

- First reported link between human listeriosis and stone fruit
 - *“Strong evidence linked one case in Massachusetts to recalled stone fruit, including food exposure interviews, receipt and shopper card data, and whole genome sequencing results showing very high genetic relatedness between the patient’s isolate and isolates from nectarines.”* CDC MMWR 3/15
- Australian fruit importer notified the firm it had detected Lm on its product
- Firm sampled and tested physical plant and products
- Firm issued a voluntary limited recall, in consultation with the U.S. FDA
- Canadian Food Inspection Agency issued a recall on the fruit packed by the firm
- Firms expanded its recall to all products packed by the company between June 1 and July 17, 2014
- Potential Contributing Factors: Unknown
- Public Health outcomes;
 - *“Although exposure to this recalled product was likely widespread, disease was very rare. Therefore, this recall and associated illness does not provide sufficient evidence to recommend that persons at higher risk for listeriosis (e.g., pregnant women, persons aged ≥65 years, and immunocompromised persons) avoid fresh stone fruits*
 - *However, it does support the need to understand risks associated with contaminated, ready-to-eat fresh fruit so that prevention strategies can be strengthened.”* CDC MMWR 3/15
- Sources:
 - Notes from the Field: Listeriosis Associated with Stone Fruit — United States, 2014 MMWR Weekly March 20, 2015 / 64(10);282-283
<http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6410a6.htm>
 - Wegmans and *Listeria*: Developing a Proactive Food Safety System for Produce – A Harvard Business School Case Study R. Goldberg and C. Snively, 2015.

2014: Apples from a California Packinghouse Consumed as Caramel Apples

- 32 persons in 11 states infected
- ? Lm outbreak strains
- 7 deaths and one miscarriage
- 89% of ill persons ate caramel apples
- 1st Lm outbreak associated with whole fresh apples
- Reported product and environmental sample positives
 - 6 zone I Lm+ PFGE match (polishing brushes, drying brushes, auto line singulator, pack line floor)
 - 1 zone III Lm+ PFGE match (wooden bin)
 - 5 subsample Lm+ PFGE match from Bidart whole fresh apples in commerce
- Potential Contributing Factors: Facility sanitary design, Equipment sanitary design, Postharvest practices, use as an ingredient in caramel apple
- Sources:
 - *FDA Investigated Listeria monocytogenes Illnesses Linked to Caramel Apples* (February 13, 2015)
<http://www.fda.gov/Food/RecallsOutbreaksEmergencies/Outbreaks/ucm427573.htm>
 - <http://bidartapplerecall.com/>

FDA Lm Policy

FDA & USDA FSIS Lm Risk Assessment

In 2003, the FDA Center for Food Safety and Applied Nutrition and the USDA Food Safety and Inspection Service published a “Quantitative Assessment of Relative Risk to Public Health from Foodborne *Listeria monocytogenes* Among Selected Categories of Ready-to-Eat Foods.” This risk assessment characterized fruits and vegetables as having a “low predicted relative risk of causing listeriosis on a per serving basis.” However, it was noted that while the contamination levels and growth rates on vegetables was anticipated to be low, the contamination rates for fruits was high, leading to a high level of uncertainty and need for more information about this food category. This risk assessment in its entirety can be found at:

www.fda.gov/downloads/Food/FoodScienceResearch/UCM197330.pdf

FDA Draft Lm Policy

In 2008, FDA issued “*Guidance for Industry: Control of Listeria monocytogenes in Refrigerated or Frozen Ready-To-Eat Foods*,” DRAFT Guidance which contained nonbinding recommendations and was distributed for comment purposes only.

www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/FoodProcessingHACCP/ucm073110.htm

The FDA also issued in 2008 a DRAFT Compliance Policy Guide Guidance for FDA Staff Sec. 555.320 regarding *Listeria monocytogenes*.

www.fda.gov/ICECI/ComplianceManuals/CompliancePolicyGuidanceManual/ucm136694.htm

These draft guidance documents will represent the Food and Drug Administration's (FDA's) current thinking on this topic when they are finalized. However, neither of these DRAFT Guidance documents has been finalized by the FDA, and they both remain in flux as DRAFT documents.

Some points to be emphasized from the DRAFT FDA policy positions are excerpted below:

“Compliance Policy Guide Guidance for FDA Staff Sec. 555.320 *Listeria monocytogenes*; Draft Guidance

- Ready-to-Eat Foods that Support Growth of *L. monocytogenes*: FDA may regard a RTE food that supports growth of *L. monocytogenes* to be adulterated within the meaning of section 402(a)(1) of the Federal Food, Drug, and Cosmetic Act (the Act; the FD&C Act) (21 U.S.C. 342(a)(1)) when *L. monocytogenes* is present in the food based on the detection method indicated in section IV.A.
- Ready-to-Eat Foods that Do Not Support Growth of *L. monocytogenes*: FDA may regard a RTE food that does not support the growth of *L. monocytogenes* to be adulterated within the meaning of section 402(a)(1) of the Act (21 U.S.C. 342(a)(1)) when *L. monocytogenes* is present at or above 100 colony forming units per gram of food (cfu/g).
- **Regulatory Acton Guidance**
 - Ready-to-Eat Foods that Support Growth of *L. monocytogenes*: The following represents criteria for recommending legal action to CFSAN/Office of Compliance/Division of Enforcement (HFS-605): *L. monocytogenes* is detected in one or more subsamples of a RTE food that supports the growth of *L. monocytogenes*.
 - Ready-to-Eat Foods that Do Not Support Growth of *L. monocytogenes*: Consult with CFSAN/Office of Compliance/Division of Enforcement (HFS-605) before recommending legal action for RTE foods that do not support the growth of *L. monocytogenes*.
 - Foods that are Not RTE Foods Consult with CFSAN/Office of Compliance/Division of Enforcement (HFS-605) when *L. monocytogenes* is present in a food that is not a RTE food.
- **Other Considerations**
 - The criteria in this guidance do not establish an acceptable level of *L. monocytogenes* in food. FDA may choose to take legal action against adulterated food that does not meet the criteria for recommending legal action to CFSAN.
 - Further, the criteria in this guidance do not excuse violations of the requirement in section 402(a)(4) of the Act (21 U.S.C. 342(a)(4)) that food may not be prepared, packed, or held under insanitary conditions or the requirements in FDA's good manufacturing practices regulation (21 CFR part 110). As set out in 21 CFR 110.80, food manufacturers must take "[a]ll reasonable precautions ... to ensure that production procedures do not contribute contamination from any source."

Guidance for Industry: Control of *Listeria monocytogenes* in Refrigerated or Frozen Ready-To-Eat Foods”; Draft Guidance

- What Should I Do to Monitor Critical Surfaces and Areas to Detect Locations that Harbor *Listeria Species* or *L. monocytogenes*?
 - Written Plan:
 - establish and implement a written plan for the collection of environmental samples from critical surfaces and areas, and for testing those samples for the presence of *Listeria species* or *L. monocytogenes*.
 - evaluate each plant, product, and process to determine the appropriate monitoring points.
 - use screening tests for the presence of *Listeria species* because these tests usually are more rapid than tests for *L. monocytogenes*.
 - test the individual samples that you collect, or test a composite that you make from multiple samples taken from a given area.
 - Critical Food-Contact Surfaces
 - collection and testing environmental samples from all, or representative sets of, such surfaces at least once every week.
 - all critical food-contact surfaces should be tested at least once each month.
 - collect environmental samples at a time that is both prior to cleanup and no sooner than the middle of production.
 - Critical Non-Food-Contact Surfaces and Areas
 - collection and testing of environmental samples from all, or representative sets of, such surfaces and areas at least once every two weeks.
 - all critical non-food-contact surfaces should be tested at least once each quarter.
- What Sampling Should I Do of Finished RF-RTE Foods?
 - Establish and implement a written plan for the periodic collection of samples of finished RF-RTE food, and for testing those samples for the presence of *Listeria species* or *L. monocytogenes* to provide a historical reference for your production facility and to validate the adequacy of your controls rather than to determine whether to release individual lots of RF-RTE food that you process.
- What Should I Do if I Detect Contamination of a Critical Food-Contact Surface or Food With *Listeria Species*?
 - If you detect contamination of a critical food-contact surface or food with *Listeria species*, we recommend that you either conduct a test to determine whether the *Listeria species* is *L. monocytogenes*, or assume that the *Listeria species* is *L. monocytogenes*.
 - If you determine that the *Listeria species* is NOT *L. monocytogenes*, we recommend that you take corrective actions regarding your plant and your processing, because the presence of any *Listeria species* suggests that conditions also are suitable for survival and/or growth of *L. monocytogenes*.

- If you either determine or assume that the *Listeria* species IS *L. monocytogenes*, we recommend that you take the corrective actions that we describe in sections XIX and XX of this document.
- What Corrective Actions Should I Take Regarding my Plant and my Processing if I Detect *Listeria* Species or *L. monocytogenes* on a Critical Surface or Area or in Food?
 - If you detect *Listeria species* or *L. monocytogenes* on a critical surface or area or in food, we recommend that you follow a corrective action plan that describes the steps to be taken, and assigns responsibility for taking those steps, to ensure that the cause of the contamination is corrected. We recommend that a corrective action plan include the following corrective actions:
 - Conduct additional sampling and testing as appropriate to determine the specific surface or area that is contaminated with *Listeria species* or *L. monocytogenes*.
 - Clean and sanitize the contaminated surface or area; and
 - Conduct additional sampling and testing to determine whether the contamination has been eliminated. If test results from the additional testing continue to be positive for *Listeria species* or *L. monocytogenes*, we recommend that you continue to clean, sanitize, sample and test until the test results demonstrate that the contamination with *Listeria species* or *L. monocytogenes* has been eliminated; and
 - Review production, maintenance and sanitation procedures to determine whether to modify the procedures to prevent contamination and make those modifications; and
 - Review the scenarios that we provide in Table 2 (see Section II of this document) as an aid to identifying causes of contamination; and
 - Check maintenance records for modifications or repairs to major equipment; and
 - Interview and observe sanitation, maintenance, and production employees to determine whether procedures were followed; and
 - Correct any identified problems that could lead to contamination.
- What Corrective Actions Should I Take Regarding Food if I Detect Contamination of a Critical Food-Contact Surface or Food With *L. monocytogenes*, or if I Assume that *Listeria* Species on a Critical Food-Contact Surface or in Food is *L. monocytogenes*?
 - For food that supports the growth of *L. monocytogenes*

FDA recommends that you establish and follow a corrective action plan that describes the steps to be taken, and assigns responsibility for taking those steps, to ensure that no finished RF-RTE food that supports the growth of *L. monocytogenes* enters commerce if:

 - The food bears or contains greater than or equal to 0.04 cfu of *L. monocytogenes* per gram of food; or
 - The food has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or whereby it may have been rendered injurious to health.

- For Food that does not support the growth of *L. monocytogenes*

FDA recommends that you establish and follow a corrective action plan that describes the steps to be taken, and assigns responsibility for taking those steps, to ensure that no finished RF-RTE food that does not support the growth of *L. monocytogenes* enters commerce if:

- The food bears or contains greater than or equal to 100 cfu of *L. monocytogenes* per gram of food.
- The food has been prepared, packed, or held under insanitary conditions whereby it may have become contaminated with filth, or whereby it may have been rendered injurious to health.

FDA Lm Policy and Applicability to Fresh Produce

Fresh produce poses a unique challenge among FDA regulated foods in that *L. monocytogenes* is a microorganism that is routinely found in the outdoor environment, and its occasional transient detection on raw produce in low numbers does not necessarily indicate poor practices or that a contamination event has occurred, due to insanitary conditions, or that it presents an elevated public health risk. This means the occasional detection of transient *L. monocytogenes* in low numbers on fresh produce RACs and food contact surfaces, where fresh produce is handled, is to be expected and must be considered and addressed in the drafting of finished product and environmental monitoring procedures for fresh produce facilities.

Finished Product Testing: Many FDA regulated manufacturer/processors routinely conduct product testing; however, this is not the case for most fresh produce establishments that handle RACs. As per the proposed FDA FSMA produce rule, FDA “tentatively concluded that product testing would be impracticable as a component of science-based minimum standards.” Due to the low prevalence, low numbers and random nature of Lm on RACs, finished product testing is not routinely used in the RAC produce industry as most produce establishments choose to not expend resources on product testing and instead focus on implementation and verification of preventive controls such as Good Agricultural Practices and Good Handling Practices.

Environmental Monitoring: The produce industry is acutely aware of the adverse public health consequences that can be associated with *L. monocytogenes* and largely embraces the strategy of seeking, destroying and preventing harborages of *L. monocytogenes* in produce facilities. However, FDA’s current draft Lm guidance has the unintended consequence of dis-incentivizing the use of the “seek and destroy” environmental monitoring strategy reduced routine testing of food contact surfaces and the adoption of practices designed to ensure that *Listeria spp* will not be detected. This is in contrast with the desired “seek and destroy” strategy intended to eliminate environmental pathogens. FDA may also wish to consider aligning their *Listeria* guidance with, for example, the USDA FSIS “Compliance Guidelines to control *Listeria monocytogenes* in post-lethality exposed tread-to-eat meat and poultry products.” The aforementioned USDA FSIS policy guidance seems to provide industry with regulatory flexibility that does not dis-incentivize use of the “seek and destroy” strategy when transient positive detections of *Listeria spp. or Listeria-like* organisms occur. An excellent review of the “seek and destroy” process can be found in Malley et al, 2015 (Journal of Food Protection 78(2) 436-445) and J. Butts Food Safety Magazine April/May 2003 www.foodsafetymagazine.com/

FSMA Preventive Controls for Human Foods

The FSMA preventive controls for human foods regulation as proposed by FDA, sets standards for firms which manufacture, process, pack or hold human food. As currently proposed, this includes produce businesses throughout the produce supply chain such as packing house operations that are FDA registered facilities and fresh-cut processors. It proposes that firms covered by this rule would be required to have written plans that identify hazards, specify the steps that will be put in place to minimize or prevent those hazards, identify monitoring procedures and record monitoring results, and specify what actions will be taken to correct problems that arise. Importantly as currently proposed, this FSMA rule would require registered food facilities including packing house operations to implement product testing (incoming raw materials, in-process and/or finished product), environmental monitoring and supplier controls. The three aforementioned FSMA Preventive Controls Rule for Human Foods provisions are likely to have a profound impact on how packing houses operate their business due to the considerations outlined above.

Preventive Controls for Lm in or on Fresh Produce

Recent produce associated foodborne illness outbreaks and product recalls have made the produce industry acutely aware of the potential adverse public health consequences that can be associated with *Lm* and fresh produce. As a consequence, the produce industry reviewed procedures, policies and practices that may contribute to *Lm* contamination of produce and has developed a number of guidance documents. The United Fresh Produce Association "*Guidance on Environmental Monitoring and Control of Listeria for the Fresh Produce Industry*," published in 2014, is currently the most comprehensive resource available to produce industry professionals. This exhaustive, fully referenced guidance document pulls not only from FDA regulatory guidance documents referenced above, but it also draws upon the lessons learned in other industry and the extensive scientific literature. Another important industry resource is the 2015 paper entitled "*Listeria* Guidance and Best Practices in Produce Facilities" from the Feb/Mar Issue of Food Safety Magazine (pp 58-63).

In 2013, the Center for Produce Safety Research Symposium included a workshop focused on *Listeria* biology and lessons learned on *L. monocytogenes* control from the meat and produce industries. The symposium drew upon lessons learned from the processed deli meat industry, whom faced similar issues with *L. monocytogenes* ten years ago and adopted a "seek and destroy" strategy.

In general, key elements of an *Lm* preventative program for fresh produce are:

- Comprehensive Good Agricultural Practices (GAP) program at the field level to keep the incidence of *Listeria* introduction into the packing or processing environment low,
- Work flow patterns within the facility that reduce the potential for cross-contamination,
- Equipment of sanitary design to reduce the potential for *Listeria* harborages,
- Thorough facility cleaning and sanitation
- a risk-based environmental testing program to verify the efficacy of cleaning and sanitation programs. Note: it is critical that root cause analyses follow any positive tests from environmental monitoring to better understand why the occurrence happened and to implement corrective actions to prevent a reoccurrence.

Additional Reference Resources are listed below.

Resources:

- *Guidance on Environmental Monitoring and Control of Listeria for the Fresh Produce Industry*, 2014, United Fresh Produce Association.
http://www2.unitedfresh.org/forms/store/ProductFormPublic/search?action=1&Product_productNumber=42425
- *Listeria Guidance and Best Practices in Produce Facilities*. 2015. Food Safety Magazine Feb/Mar Issue: pp 58-63. <http://www.foodsafetymagazine.com/magazine-archive1/februarymarch-2015/listeria-guidance-best-practices-in-produce-facilities/>
- Suslow, T. and L. Harris 2000. Guidelines for controlling *Listeria monocytogenes* in small- to medium scale packing and fresh-cut operations. <http://anrcatalog.ucdavis.edu/pdf/8015.pdf>
- Tomkin, R.B. 2002. Control of *Listeria monocytogenes* in the food processing environment J. Food Prot 65(4)709-725.
- Tomkin, R.B. et al. 1999. Guidelines to Prevent Post-Processing Contamination from *Listeria monocytogenes*. Dairy, Food & Environmental Sanitation August Issue pp: 551-562.



***Listeria monocytogenes* Produce Safety Policy
Discussion Guide
PMA Issues Leadership
Produce Safety Policy Conference**

Arlington, VA
June 16-17, 2015

Day 2 – Wednesday June 17, 2015

Group 1: Knowns (Whitaker)

Produce Lm Preventive Controls

- What preventive controls can be effectively used to reduce public health risk from Lm associated with RACs?
- What impediments are there to implementing effective preventive controls for Lm in or on fresh produce?
- What approaches are available to verify efficacy of preventive controls?
- What impediments are there to implementing effective preventive controls for Lm in or on fresh produce?
- What resources are needed to develop Lm preventive controls for fresh produce operations?
- What research needs to be done?

Produce Lm Monitoring: Strategies, Training & Education

- It is anticipated that the new FSMA regulations will have a major impact on packinghouses with possible mandatory environmental testing and product testing provisions.
- What are the training requirements for the industry around Lm control and how will that outreach and training be accomplished?

Group 2: Unknowns: Assessing Lm Risk from Produce (Gorny)

- How can a risk assessment be used to shape Lm policy and is this an approach that would benefit the produce industry?
- What are the data and research needs and how would these be made available?
- What resources are needed to develop a Lm risk assessment for produce?
- What research needs to be done?

The PMA Science & Technology team will continue to be engaged and striving to assure that Lm produce safety policy protects consumers while also being sound and practicable to implement. We strive to deliver membership value in year around communications and education outreach, to keep members abreast of important food safety regulatory developments. If you have further questions please do contact any of the members of the PMA Safety and Technology Team Produce Safety team and/or visit the PMA Food Safety homepage at:
<http://www.pma.com/topics/food-safety>

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