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Listeria in Food Processing Environments

PHO Rounds Discussion

Food Safety Science Unit

Food Safety Systems Development Branch

February 2024

Ontario

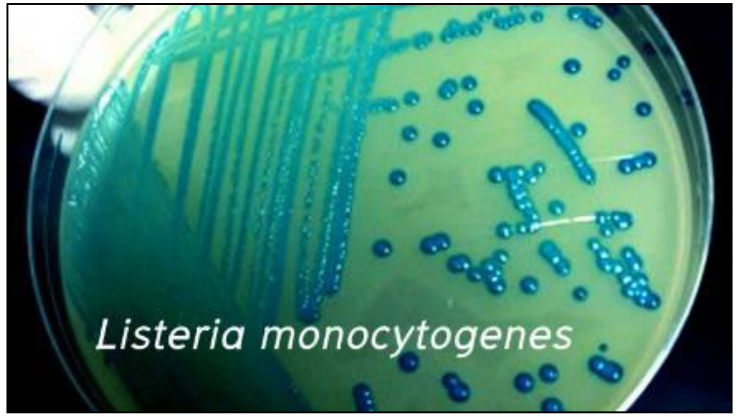
Learning Objectives

By the end of this session, you should be able to:

1. Describe the dangers of *Listeria* and what it is
2. Describe the challenges of controlling *Listeria* in a food processing environment
3. Discuss the roles of environmental monitoring and root cause analysis to understand *Listeria* issues in specific food production environments
4. Describe strategies for managing *Listeria* in food production environments

Dangers of *Listeria*

- *Listeria* includes many different species, including the pathogenic *Listeria monocytogenes (L. mono).* Testing for *Listeria* species (*L*. spp.) will positively identify any of these.
- *L. mono* causes listeriosis, a serious disease, especially among immunocompromised people.
    - Symptoms include flu-like symptoms, fever, headache, muscle aches, confusion.
    - More severe: miscarriage and stillbirth in pregnant women; convulsions and other severe symptoms including death.



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Notable *Listeria monocytogenes* Outbreaks

- In June 2023, there was an outbreak in 16 states linked to leafy greens. 19 illnesses and 18 hospitalizations were associated with this outbreak.
- In March 2023, there was an outbreak in 6 states linked to deli meat and cheese. 16 illnesses, 13 hospitalizations and 1 death were associated with this outbreak.
- In November 2022, there was an outbreak in 11 states linked to ice cream. 28 cases, 27 hospitalizations and 1 death were associated with this outbreak.
- Global news article in 2021 stated *Listeria* outbreaks are on the rise across Canada.
  - In 2019, 53 products triggered a recall warning for *Listeria monocytogenes*
  - In 2008, Canada experienced its worst listeriosis outbreak, with 57 total cases confirmed and 22 deaths traced back to deli meats produced at a Maple Leaf Food facility in Toronto, ON.

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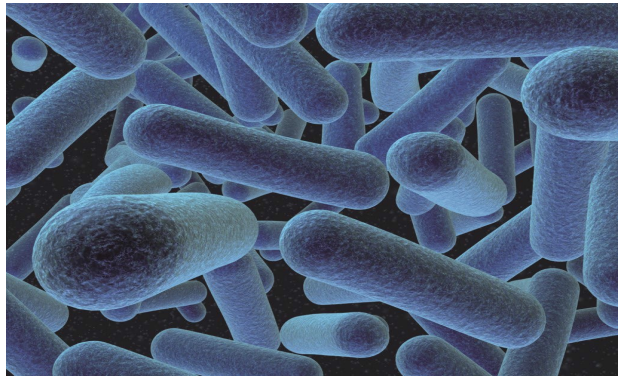
Challenges of Controlling *Listeria*

- *Listeria* is distributed widely in the environment, including in the air, soil, water, dust and plant material.
- Because of this, controlling *Listeria* in processing plant environments can be very challenging, as it can be easily introduced through raw materials, equipment, packaging and also people.
- Additionally, *Listeria* has the unique ability to grow in refrigerated conditions, unlike most other pathogenic bacteria. It is also resistant to freezing, drying, and high levels of salt, nitrite and acid.

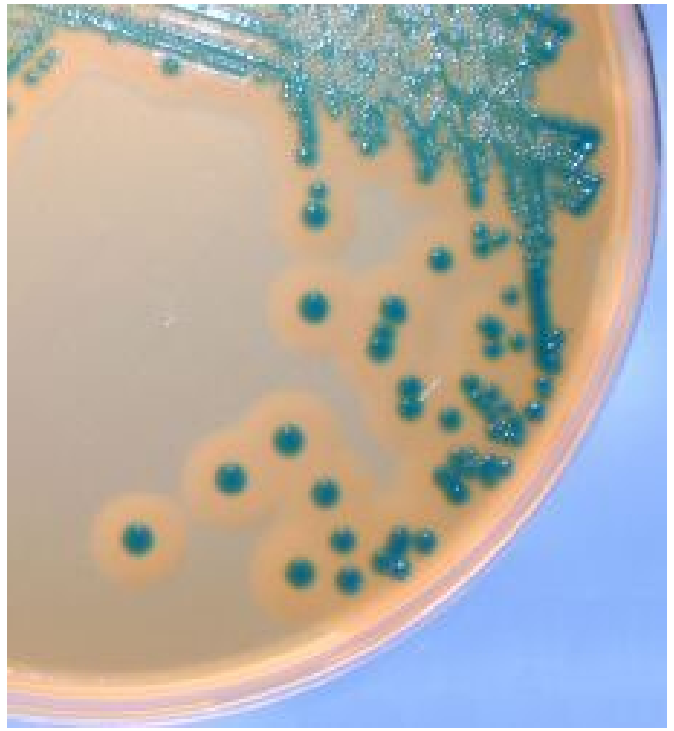


Challenges of Controlling *Listeria*

- *Listeria* can form difficult to remove biofilms.
  - Biofilms are invisible, sticky layers of bacteria, sugars, proteins and other substances that form and adhere strongly to surfaces.
  - These layers shield the bacteria from the effects of sanitizers and are not easily removed from equipment or other surfaces.
- There have been instances in licensed OMAFRA facilities where we have found *Listeria,* the plant cleaned and sanitized, and we had negative follow-up tests. However, years later we found the same *Listeria* again in the same facility.
  - This highlights the persistence of *Listeria* and the importance of ensuring it is properly dealt with.

Challenges of Controlling *Listeria*

- When introduced into the processing plant, *Listeria* spp. can inhabit and multiply in various niches in the facility (e.g. equipment crevices, refrigeration units, floor drains, standing water).
- Without proper hygienic practices, *Listeria* spp. can be directly or indirectly transferred from these niches to the Ready-To-Eat (RTE) product through cross-contamination.
- RTE products are of particular concern for contamination with *Listeria* spp. because they may support the growth of the bacteria during refrigerated storage.
- In addition, since RTE products are often consumed without further cooking, there is no control of this pathogen by this consumer.



Importance of an Environmental Monitoring Program

- Environmental Monitoring Programs (EMPs) that test surfaces for microbial contamination.
- EMPs are important to help to identify locations that may harbor pathogens and how they may move throughout in a plant.
  - They provide information regarding sanitation and GMP effectiveness.
  - Positive results enable plant operators to “seek and destroy” harborage areas and prevent further cross contamination.
- This proactive approach to monitoring helps prevent contamination on food products and foodborne illness.

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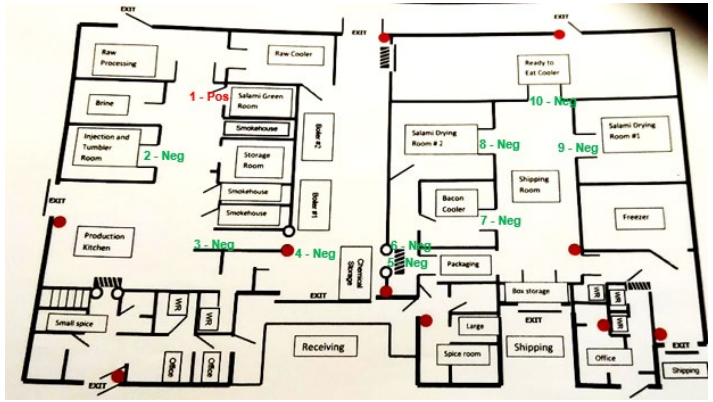
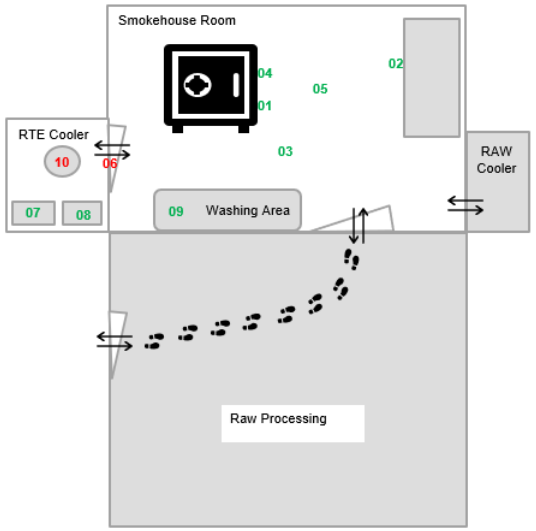
Role of an Environmental Monitoring Program

- OMAFRA uses EMPs as a routine monitoring program and as a follow up to finished product testing that is positive for *Listeria monocytogenes*.
  - EMPs gather data from the whole facility instead of just one finished product.
  - Using EMPs as a follow up has been effective in mitigating contamination and finding the source.





- Various surfaces are swabbed in a plant that include Food Contact Surfaces (FCS) and non-Food Contact Surfaces (NFCS).
  - Swab locations are broken down into four zones with Zone 1 representing Food Contact Surfaces and Zones 2-4 representing non-Food contact surfaces.

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Sampling Locations

High Risk	**Zone 1** Food Contact Surfaces	Slicers, peelers, fillers, hoppers, screens, conveyor belts, air blowers, knives, racks, tables
Moderate Risk	**Zone 2** Non-Product (Near) Contact Surfaces	Exterior, under, and framework of equipment, refrigeration units, equipment housing, switches
Low Risk	**Zone 3** Other Areas Within Finished Product (RTE) Room	Air return covers, phones, hand trucks, forklifts, drains, wheels
Minimal Risk	**Zone 4** Area Outside of RTE Room	Locker rooms, cafeteria, hallways, loading dock, maintenance areas

Swab Distribution

- EMPs should be suited for the type of operation it is intended for and representative of the overall facility.
  - Swabs should not be collected in raw processing areas and should focus on RTE processing areas only.
- Follow-up swabbing to positive results should be collected in similar zones to the initial visit to verify if *Listeria* is still present.
- The following table is the typical distribution of swabs in OMAFRA's EMPs.
  - Majority of the swabs focus on Zone 1 which presents the highest food safety risk.
  - This distribution is subject to discretionary change based on the plant's specific design and size.

	Zone 1	Zone 2	Zone 3	Zone 4
% of total swabs taken	50%	35%	15%	0%
If 10 swabs are taken, # of swabs:	5 FCS	3 NFCS	2 NFCS	0 NFCS

- Zone 4 may be considered as part of re-swabbing in response to a positive results.

Root cause Analyses

- A Root Cause Analysis (RCA) in food production is a systematic process used to identify the fundamental reasons behind the contamination. An RCA aims to uncover the primary cause of the contamination.
- In the event of a positive result, an RCA should be conducted to identify the fundamental factors that contribute to the contamination.
- The following items should be reviewed to help determine any potential causes:
  - Sanitation practices, procedures and records
  - Proper flow (of product, personnel, etc.)
  - Storage and handling practices
  - Personnel practices
  - Equipment and maintenance
  - Pest control
  - Staff training practices

- Understanding that every plant situation is unique, it is recommended to consider and examine the plant's specific processes of the plant to help find the root cause of the contamination.

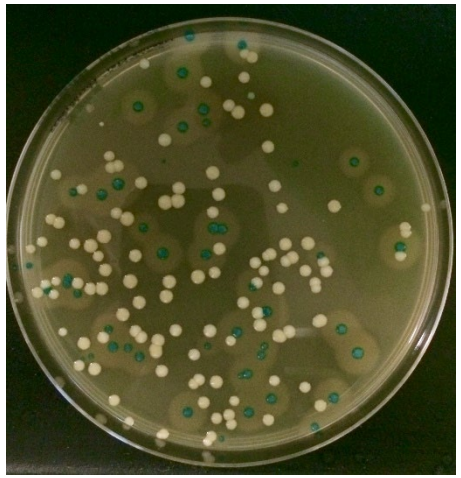
Root cause Analyses

- Once potential causes are identified, corrective actions should be developed and implemented which may include:
  - Changes or improvements to practices and processes
  - Equipment and facility upgrades
  - Staff training procedures
- Once the corrective actions have been determined and implemented, their effectiveness should be verified through follow-up swabbing.
- Lessons learned from the RCA should be incorporated into ongoing quality control and operational practices. By systematically addressing root causes, a food processing facility can enhance its overall quality and safety, reducing the risk of issues recurring.

Listeria spp. Swabbing Baseline in FSMPs

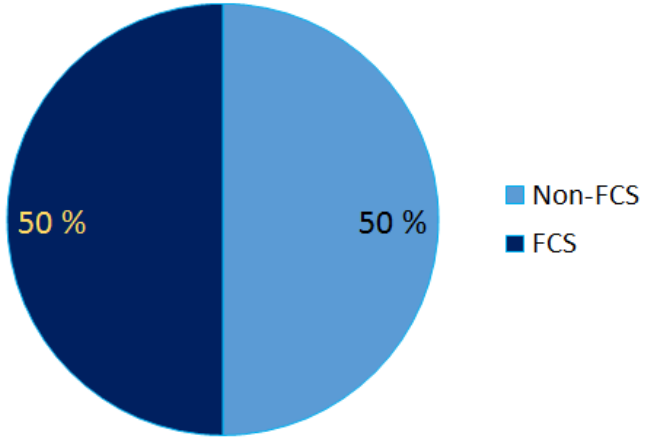
Primary objectives:

- Collect data on the presence of *Listeria* spp. on FCS and non-FCS in provincially-licensed meat plants that produce RTE product.
- Utilize data to further develop *Listeria* spp. environmental swabbing program in the MIP that would assist the program to be more proactive in determining risk for product contamination.
- Utilize inspection staff to perform and collect *Listeria* spp. environmental swabs to further their training and expertise in risk in the RTE plant environment.



Listeria spp. Swabbing Baseline

- In total, 83 different plants across the province were sampled (Oct. 2016 – April 2018).
- In total, 1680 swabs collected, 10 swabs per plant visit
  - 15% were re-test swab samples, collected following positives (upon agreement with operator)
- All swabs were collected by Inspection staff



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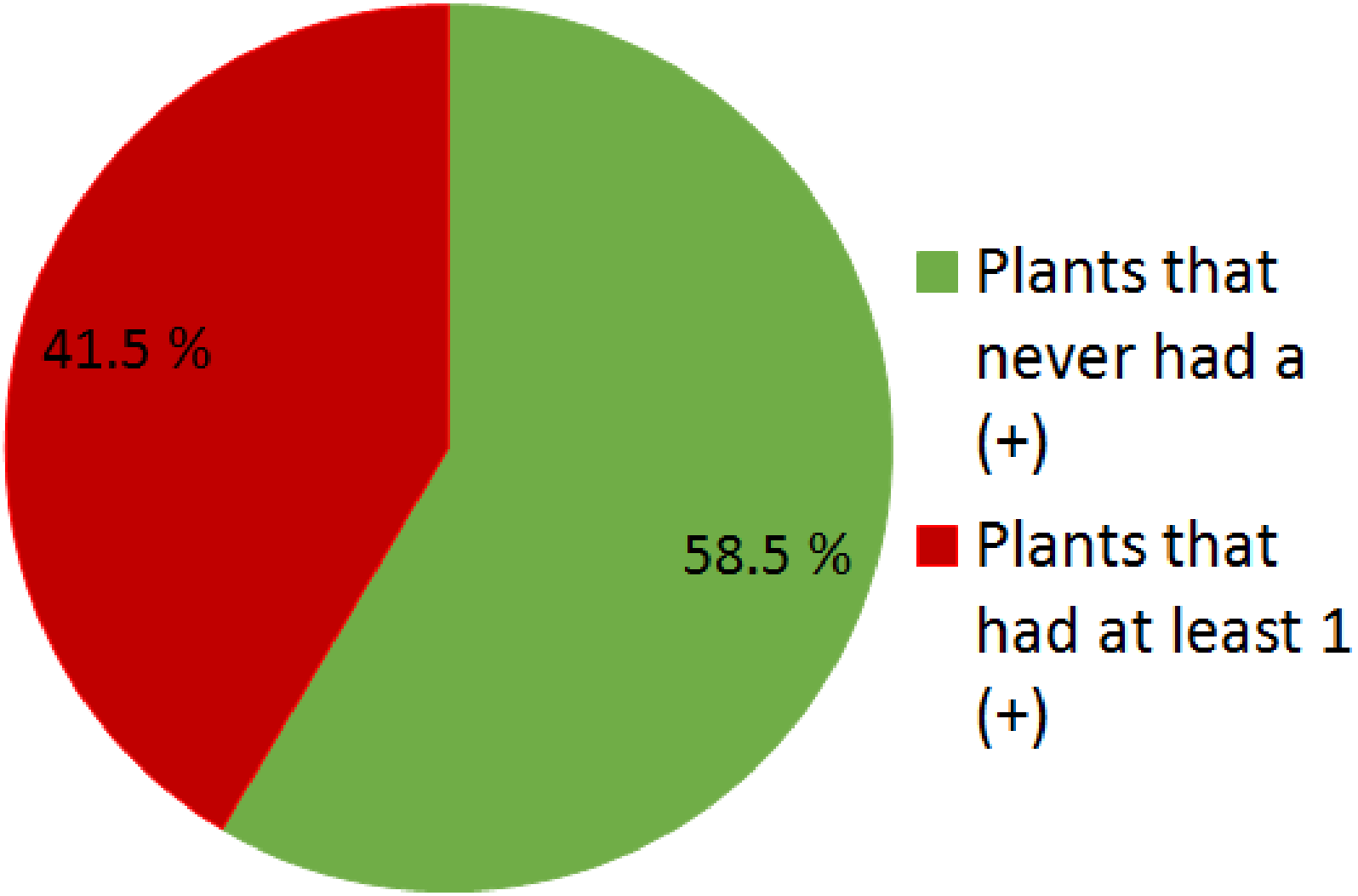
Listeria Baseline: Results

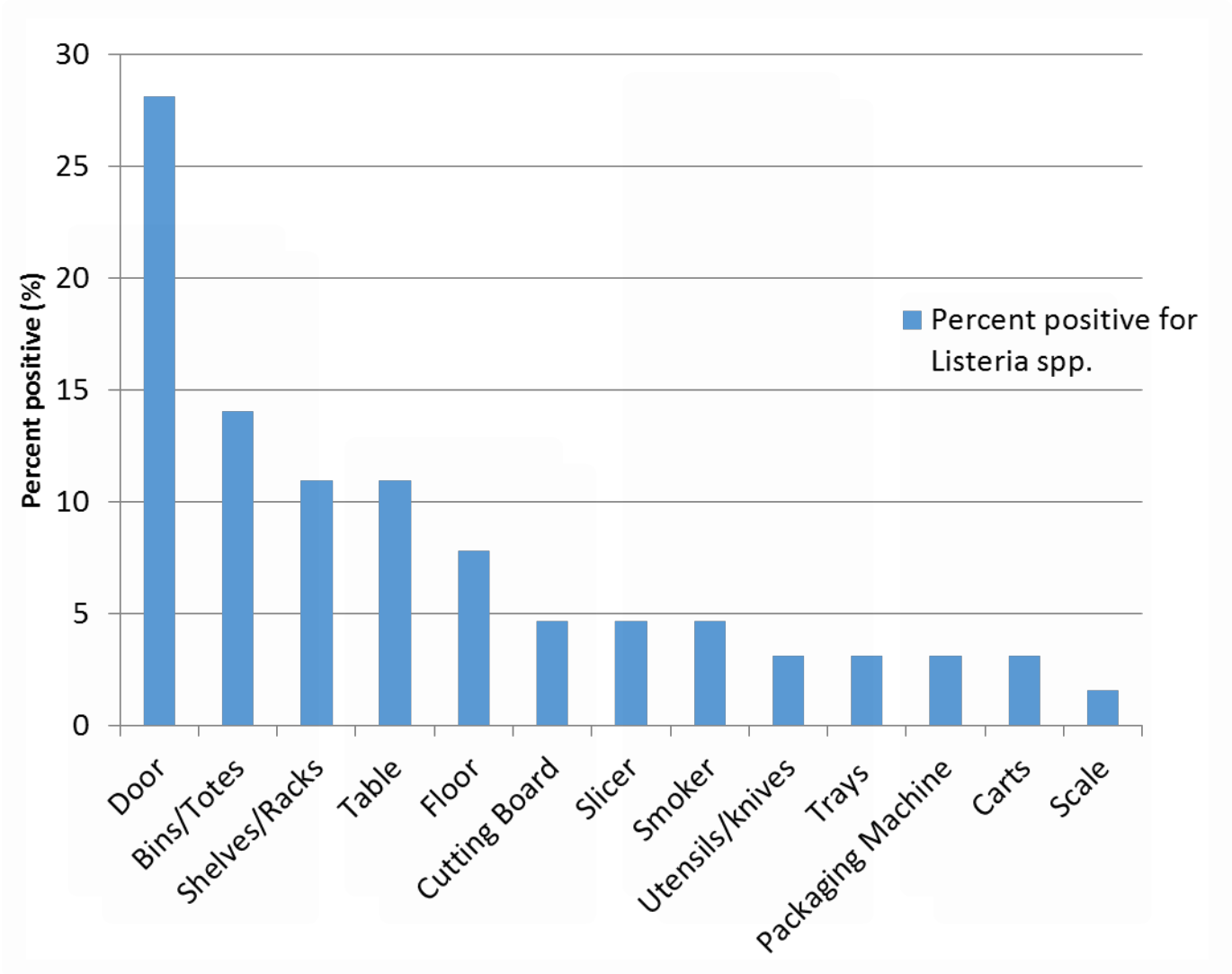


Listeria Baseline: Results

- Visit Sequence
  - 1st visit: 30% of visits had a positive result
  - 2nd visit: 22% of visits had a positive result
    - Possible that first visit served educational/deterrent purpose to reduce contamination (significant difference)

- When we identified plants with recurrent/persistent *Listeria* spp. issues, we performed extra visits for plants that had positive swabs:
  - 1st re-test: 56% of visits had positive results
  - 2nd re-test: 75% visits had positive results
- More serious contamination problems identified.
  - Plants that struggled to eradicate… *really struggled*

Listeria spp. Baseline: by Surface



The study found a number of commonly handled surfaces testing positive.

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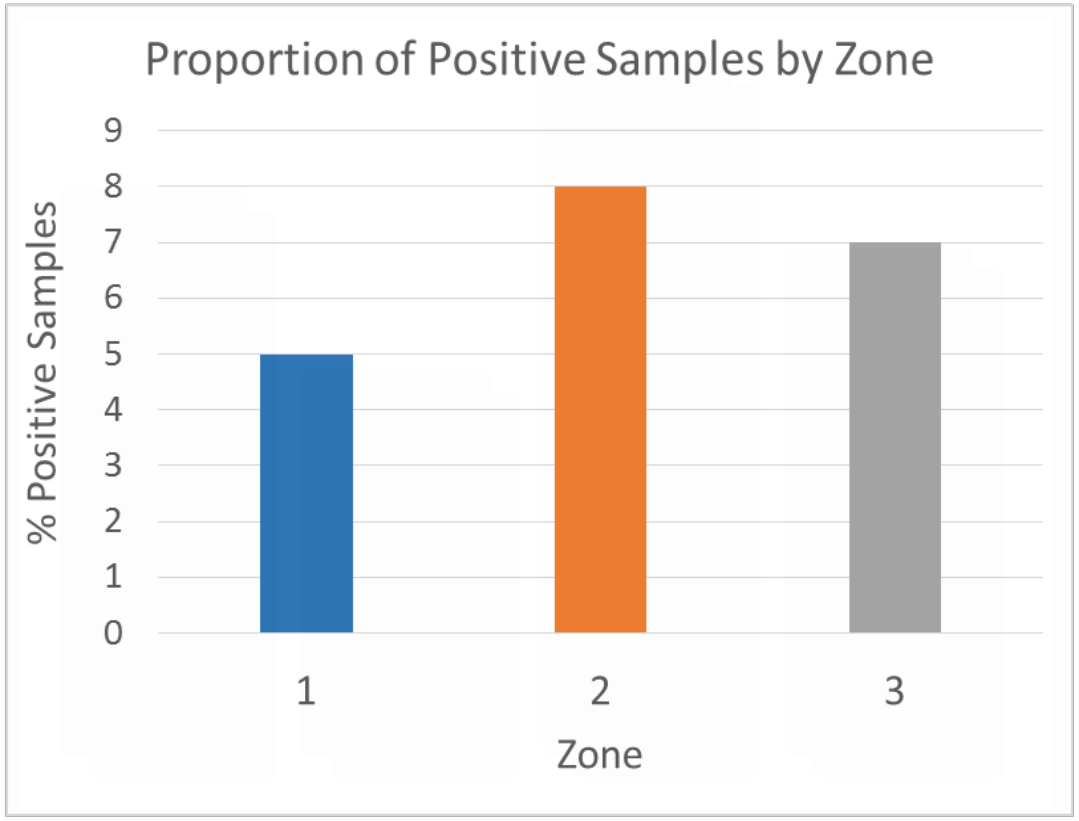
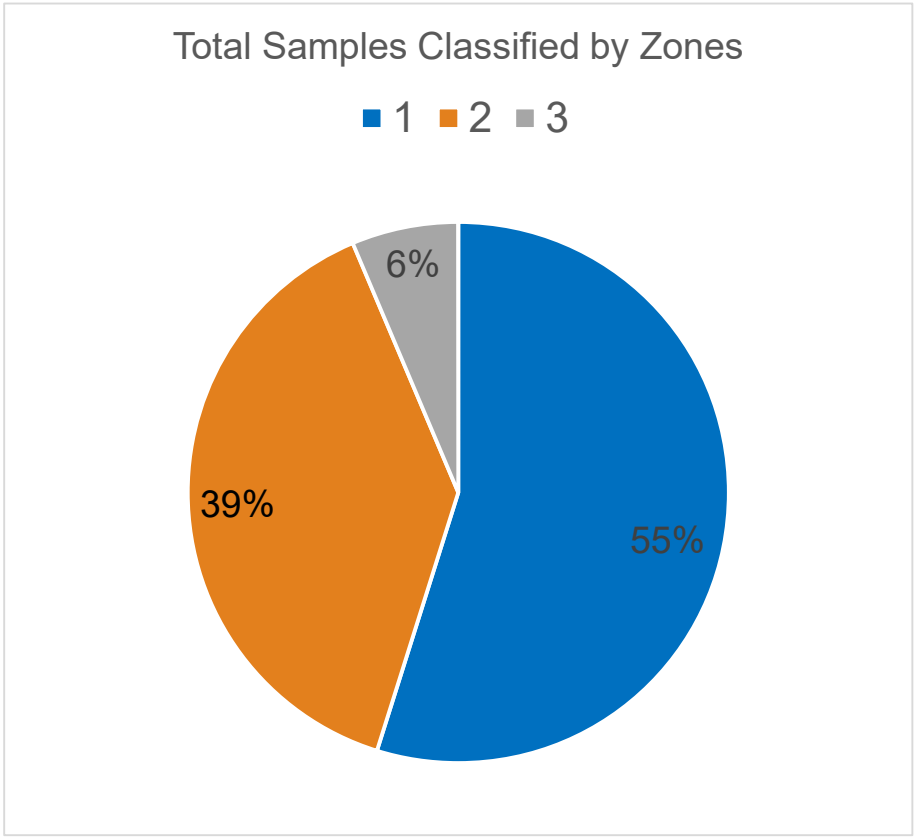
Listeria Baseline by Zone

- The majority of samples taken were Zone 1 samples (55%)
- Zone 2 had the highest proportion of positive samples (8%), followed by Zone 3 (7%), and then Zone 1 (5%)





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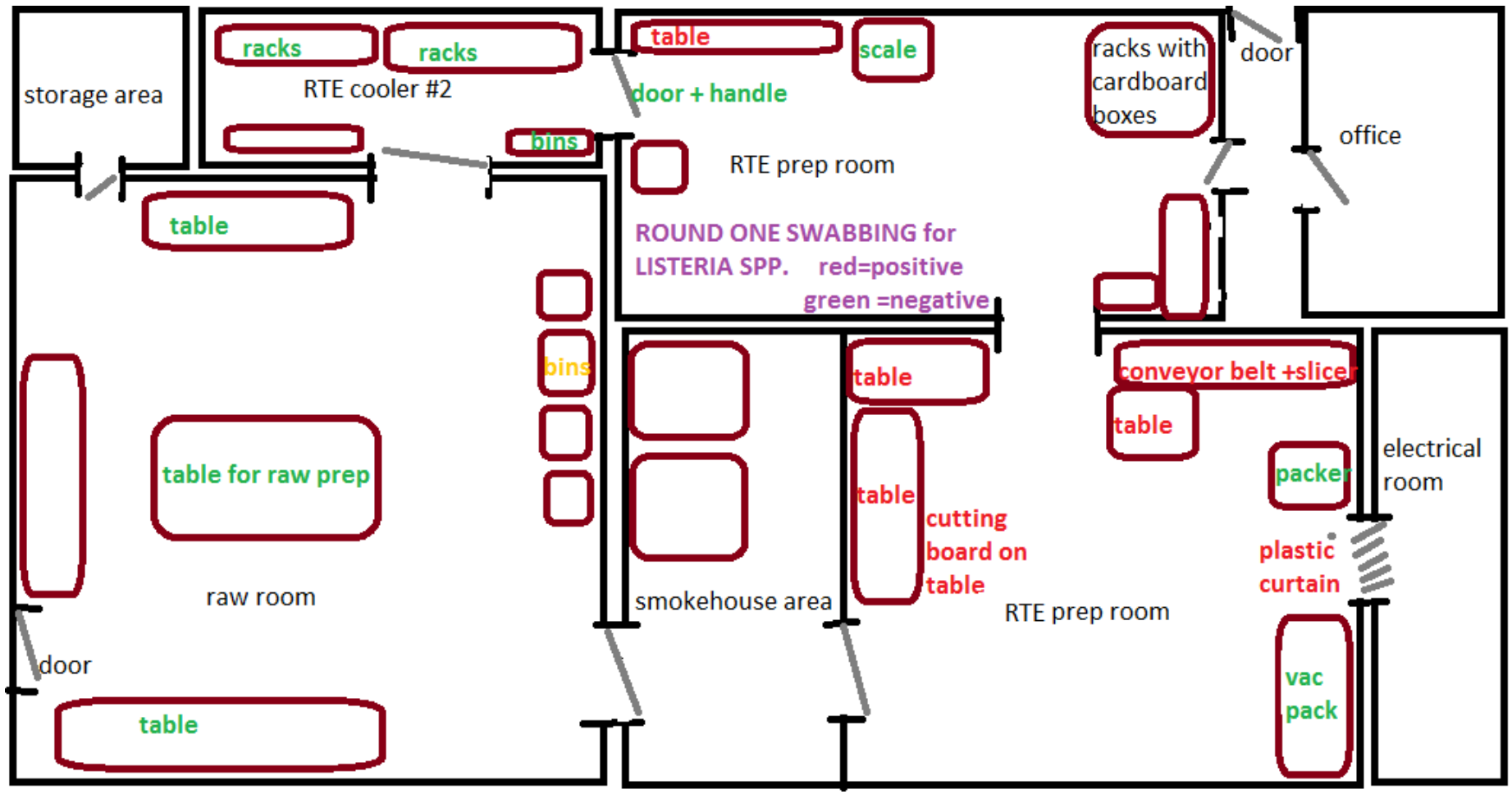
Listeria spp. baseline

- Study suggested that an ongoing routine swabbing program for all FSMPs producing RTE product would be effective in reducing risk at plants of *Listeria* being in product.
- The low levels of *Listeria monocytogenes* found in RTE product in finished product sampling suggest the biggest cause root cause is cross-contamination with contaminated surfaces in plant; the swabbing pilot corroborated this hypothesis.
- This work highlighted issues in provincially licensed FSMPs.
- It is reasonable to assume PHU inspected RTE facilities may likely have similar issues in retail areas of FSMPs.
- Following this baseline, a formal *Listeria* spp. EMP was launched across all FSMPs and as of July 2023, EMP programs are in all OMAFRA inspected facilities.

Challenges of Controlling *Listeria*



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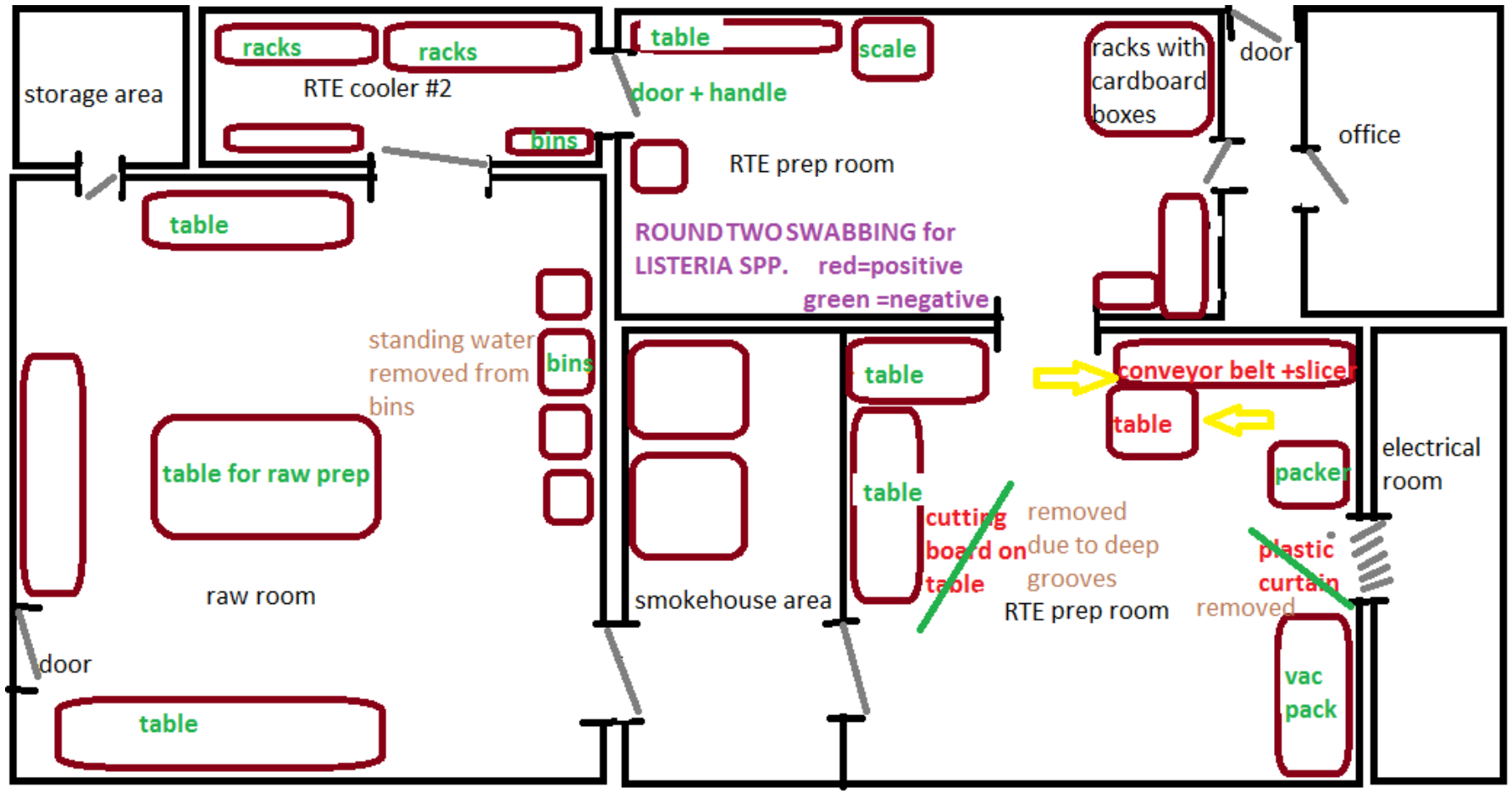
Challenges of Controlling *Listeria*



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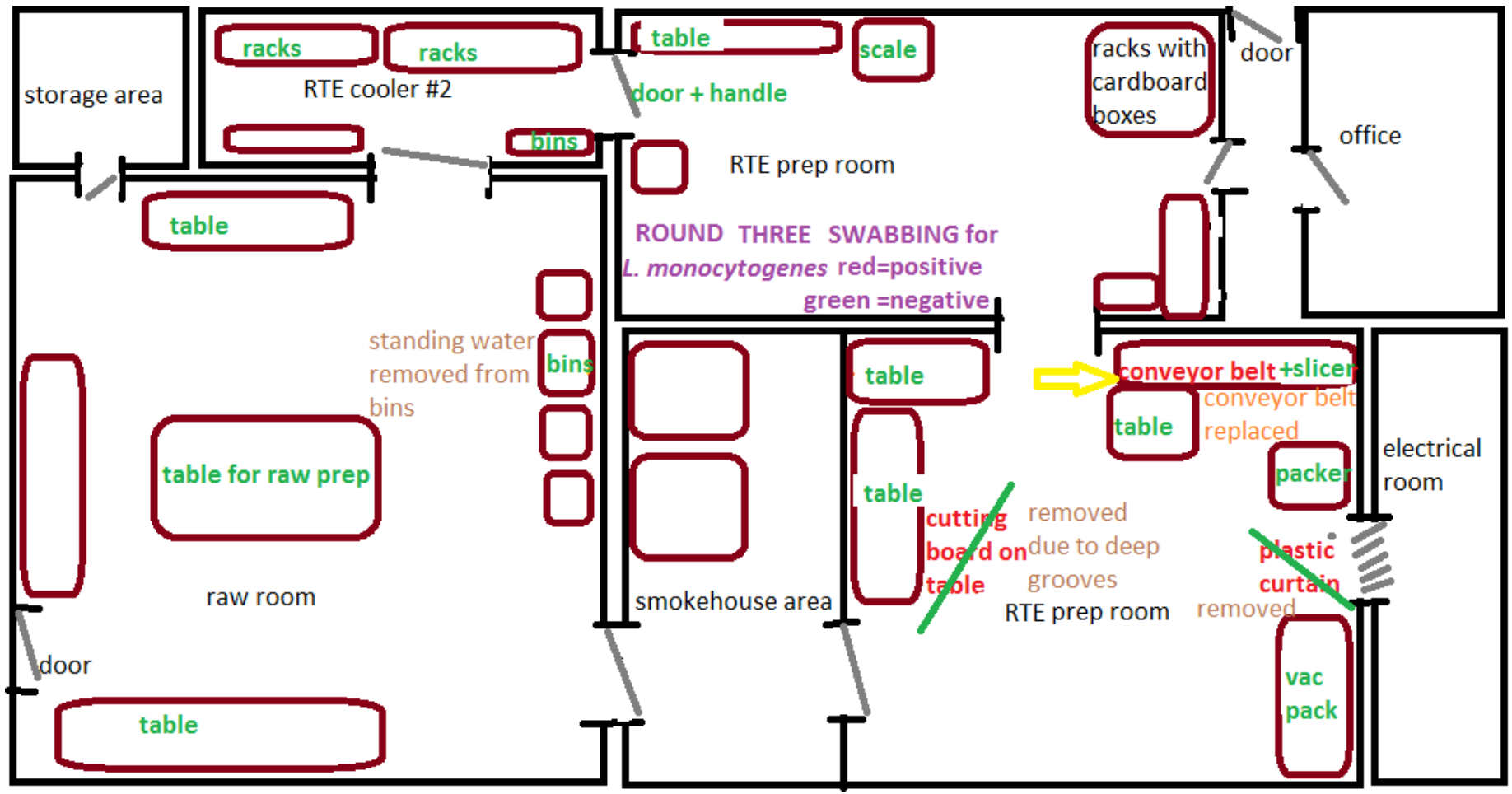
Challenges of Controlling *Listeria*



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Strategies for Managing *Listeria*

Sanitation

- An effective sanitation plan is the most effective way to limit the growth of *Listeria.*
- The following are some cleaning tips to control *Listeria*:
  - Sanitize equipment/tools before and after use, especially in niches where *Listeria* spp. can collect
  - Keep floors free of standing water and as dry as possible
  - Allow surfaces to completely dry before applying sanitizer
  - Empty, clean and sanitize coolers regularly when there is no exposed ready-to-eat product present

Strategies for Managing *Listeria*

Proper Food Handling of RTE Products

- You can reduce the chance of *Listeria* contamination of your product after processing by:
  - Limiting contact between product, surfaces and hands before it is packaged
  - Ensuring all staff have clean gloves, smocks, sleeves, aprons and waterproof footwear
  - Having knives and other equipment dedicated for use only in ready-to-eat areas, and sanitizing them
  - Instructing and training new employees unfamiliar with proper handling

Strategies for Managing *Listeria*

Plant Design and Maintenance

- In ready-to-eat work areas and coolers:
  - Eliminate or minimize traffic flow between ready-to-eat and raw areas. Staff should wash hands and change protective clothing when moving from one area to another
  - Store raw products and RTE products in different areas
  - Ensure ceiling, floor and walls are smooth, sealed and impervious to moisture
  - Have floors that slope towards drains to prevent accumulation of standing water
  - Avoid maintenance activities and repair work during work hours

Resources

- Health Canada Policy on Listeria monocytogenes in RTE Foods
- CFIA Guidance on controlling Listeria monocytogenes in RTE foods
- 3M Environmental Monitoring Handbook for Food and Beverage Industries
- CDC Summary of Listeria Outbreaks since 1998

Questions?

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