

A Rapid Response Approach to Seek and Destroy *Listeria monocytogenes* in a Ready-to-Eat Manufacturer Supplying the UK Retail Sector

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Introduction

Presence and persistence of *Listeria monocytogenes* can be problematic in food manufacturing environments.^{1,2} Preventing post-processing *L. monocytogenes* contamination is challenging as the pathogen is ubiquitous and can persist in food processing environments for years.³ This may lead to end-product contamination which can have severe consequences for ready-to-eat (RTE) food manufacturers with loss of customer confidence and business closure.

The seek-and-destroy process is a systematic approach to finding sites of persistent strains (niches) in food processing plants, with the goal of either eradicating or mitigating effects of these strains.³

Purpose and approach

A RTE manufacturer supplying the UK retail sector identified presence of *L. monocytogenes* in finished product and environmental isolation for *Listeria* spp. The manufacturer sought independent technical expertise from the ZERO2FIVE Food Industry Centre to address the issue.

The purpose of this project was to implement an independent rapid response intervention to effectively implement a 'seek and destroy' approach to reduce and eliminate the sources of *Listeria* using a multidisciplinary Listeria Action Team.

The entire rapid response project was completed in six weeks in a number of phases to identify problem areas and determine non-conformities.

Methods and results

Phase one – locating the issue

Review of historic product testing

Historic (8 months) finished-product *Listeria* spp. testing results ($n=2566$) were reviewed. Forty six results were out of specification i.e. 2% of samples.

One product range, manufactured in a segregated area presented the highest incidence of *Listeria* spp. (82%). As indicated in Table 1, products from production area 4 had the highest incidence of *Listeria* spp.

Table 1. Finished product *Listeria* spp. positive results by production area ($n=2566$).

Month	Production areas					<i>Listeria</i> spp. identified	Total
	1	2	3	4	5		
1	0	0	0	0	1	<i>L. innocua</i>	1
2	0	0	1	0	0	<i>L. innocua</i>	1
3	0	0	0	2	0	<i>L. monocytogenes</i>	2
4	0	0	0	1	0	<i>L. monocytogenes</i>	1
5	0	0	0	3	0	<i>L. monocytogenes</i>	3
6	2	1	0	16	0	<i>L. innocua</i> and <i>L. monocytogenes</i>	19
7	0	0	1	9	2	<i>L. welshimeri</i> and <i>L. monocytogenes</i>	12
8	0	0	0	7	0	<i>L. monocytogenes</i>	7
Total	2	1	2	38	3	N/A	46

Creating a multi-disciplinary Listeria Action Team

A multi-disciplinary Listeria Action Team was created to identify and address the issue of reoccurring positive *L. monocytogenes* finished products in area four.

The Listeria Action Team consisted of staff ($n=8$) including senior management, engineering staff, hygiene operatives and food handlers from area four.

The Listeria Action Team was led by an independent technical specialist from the Food Industry Centre with experience of managing listeria in food manufacturing environments.

Phase two – identifying the issue

Identifying non-conformities in Area 4

The Listeria Action Team completed documented observations of GMP and GHP in area 4 twice a day over a 4 week period ($n=40$). The findings were reviewed and categorised according to six classifications namely people, GMP, equipment, environment, GHP and fabrication.

Table 2. Intervention actions implemented to address observed non-conformities in Area 4 according to six categories.

Category	Non-conformity observed	Intervention actions
1. People	<ul style="list-style-type: none"> Staff movement between high care and low risk Lack of supervision in area Operators touching floor Poor hand wash practices 	<ul style="list-style-type: none"> Barrier system to be re-engineered to prevent movement of staff Supervision levels increased Listeria Awareness training for all staff
2. Good Manufacturing Practices (GMP)	<ul style="list-style-type: none"> Stacking ingredient trays - increased risk of pathogen cross contact Excess packaging in Area 4 Ingredient handling and storage on floor 	<ul style="list-style-type: none"> Re-train staff to not stack trays, GMP training Improve packaging storage facilities Purchase 'dollies' to prevent ingredients touching floor
3. Equipment	<ul style="list-style-type: none"> Equipment and utensils stored on floor 	<ul style="list-style-type: none"> Redesign storage facilities in area Remove redundant equipment Retrain staff in GMP
4. Environment	<ul style="list-style-type: none"> No evidence of transfer of decontaminated raw materials into Area 4 	<ul style="list-style-type: none"> Review and revise current transfer practices and records, verify and validate Re-train staff in Listeria awareness and transfer procedure
5. Good Hygiene Practices (GHP)	<ul style="list-style-type: none"> Wet production floor Use of medium pressure hose for inter process clean 	<ul style="list-style-type: none"> Re train staff in GHP verify and validate.
6. Fabrication	<ul style="list-style-type: none"> Product contact transfer equipment, seam welds damaged Floor damaged, uneven, water pooling Floor / kerb junction cracking wet Entry to low risk open 	<ul style="list-style-type: none"> Upgrade stainless steel welds on all equipment in area Relay floor to minimise water pooling Dry and seal floor kerb junction Lock entry to low risk

Development and implementation of intervention actions

To address the observed non-conformities, suitable actions were identified, agreed and implemented by the Listeria Action Team (Table 3).

Phase three – resolving the issue

Evaluation of the intervention actions

The Listeria Action Team implemented a 'zonal' Listeria Environmental Monitoring Plan to determine the impact of the intervention actions implemented in area four. Figure 1. highlights the total number of positive *Listeria* spp. results post-clean and mid-production over a four week period following the intervention actions.



Figure 1. Number of *Listeria* spp. positive environmental swabs in area 4 following intervention ($n=537$)

As indicated in Figure 2, a reduction of *Listeria* spp. results in Zone 2 and Zone 3 was identified following implementation of the interventions, suggesting origin of the pathogen to be environmental.



Figure 2. *Listeria* spp. positive swab results by zone following intervention ($n=537$).

Following implementation of the intervention actions, and four weeks of environmental monitoring, no further issues with *Listeria* spp. were identified.

Conclusions

This research has followed a focused approach to address the increased incidence of *Listeria* spp. in the environment and finished product manufactured in area 4. The study demonstrated effective interventions over 4 weeks in the following areas:

- Knowledge and skills:** team members in area 4 benefitted from additional training in GMP, GHP and Listeria awareness.
- Supervision:** Increased presence, GMP audits and two way communication in the area improved the housekeeping standards.
- Facilities:** Investment and maintenance of fabrication and equipment was completed which reduced risk of pathogen harbourage locations.
- Verification and validation of interventions:** Implementation of a 'zonal approach' to environmental swabbing provided logical approach to monitoring and effectiveness of interventions.
- Senior Management Commitment:** dedication to the Listeria Action Team, and implementation of the 'seek and destroy' approach, contributed to improving the food safety culture of the business.

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References

- Ferreira V, Wiedmann M, Teixeira P, et al. (2014) *Listeria monocytogenes* persistence in food-associated environments: epidemiology, strain characteristics, and implications for public health. *J Food Prot* ; 77: 150-170.
- Elson R, Awofisayo-Okuyelu A, Greener T, et al. (2019) Utility of Whole Genome Sequencing To Describe the Persistence and Evolution of *Listeria monocytogenes* Strains within Crabmeat Processing Environments Linked to Two Outbreaks of Listeriosis. *J Food Prot*; 82: 30-38.
- Malley T, Butts J And Wiedmann M. (2015) Seek and Destroy Process: *Listeria monocytogenes* Process Controls in the Ready-to-Eat Meat and Poultry Industry. *J Food Prot* ; 78: 436-445.