Ministry for Primary Industries
Manatū Ahu Matua

Guidance Document

Guidance for the Control of *Listeria monocytogenes* in Ready-to-eat Foods Part 3: Monitoring Activities

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Title

Guidance Document: Guidance for the Control of Listeria monocytogenes in Ready-to-eat Foods Part 3: Monitoring Activities

About this document

The Ministry for Primary Industries (MPI) has developed a series of documents "Guidance for the control of *Listeria monocytogenes* in ready-to-eat foods" that address different areas of *L. monocytogenes* management in a food manufacturing or processing environment.

These guidelines are intended to assist food operators to develop, implement and review control measures for *Listeria monocytogenes* in the context of a Risk Management Programme (RMP) or Food Control Plan (FCP). The guidelines are intended to support but do not replace any specific requirements for *L. monocytogenes* and/or other pathogen management as described in New Zealand legislation, such as the Animal Products Act 1999, for dairy and seafood, or under the Food Act 2014.

Related Requirements

The documents in the series Guidance for the control of *Listeria* monocytogenes in ready-to-eat foods are:

(1) Part 1: *Listeria* Management and Glossary; and

(2) Part 2: Good Operating Practices (GOPs); and

(3) Part 3: Monitoring Activities; and

(4) Part 4: Corrective Actions.

Document history

Previous Version Date	Current Version Date	Section Changed	Change(s) Description
December 2012	February 2017		• Split Part 3: Microbiological testing for verification of the control of *Listeria monocytogenes* into two documents; • New format and branding; • New section numbering; • Updated text for improved clarity • No technical content change

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Contents

1 Purpose

The document series "Guidance for the control of *Listeria monocytogenes* in ready-to-eat foods" have been developed by the Ministry for Primary Industries (MPI). This document is Part 3 in the series and provides guidance on the verification of *Listeria* control measures through testing. This document should be used in conjunction with the other documents in the series to provide an overall strategy for managing *Listeria* in a ready-to-eat (RTE) food operation.

2 Background

2.1 What is covered by this Part?

This Part outlines the tools that can be applied to verify the effectiveness of *Listeria* control measures, with a focus on the role of microbiological testing.

This Part describes how to set up a microbiological testing programme for the processing environment and product for the purposes of verifying that the *Listeria* control measures in place are effective. Testing of product for compliance with other customer requirements may be in addition to this.

In the event that *Listeria* is detected there are a variety of responses identified that can be undertaken taken to bring the process back under control. This may include additional microbiological testing to demonstrate that control has been achieved. These responses are described in Part 4.

This guidance may provide some useful information for those food operators who:

- are developing new operations and/or product lines or ranges; or
- are reviewing existing policies and procedures for the control of *Listeria*; or
- may have *Listeria* control measures described elsewhere, e.g. dairy and seafood.

The key source of listeriosis cases is the consumption of foods contaminated with *L. monocytogenes,* in particular those that:

- are ready-to-eat; and
- support the growth of *Listeria*; and
- are stored under refrigeration temperatures; and
- have a long shelf-life.

All *Listeria* species can be found in the same niches in a processing environment and so finding any *Listeria* identifies the need to review or put in place additional control measures. Therefore in this document the term '*Listeria'* is used to include all *Listeria spp*. except where the actions relate specifically to the major pathogenic species *Listeria monocytogenes*, and in particular where it is found in a RTE food or on a product contact surface.

2.2 How does this Part relate to the rest of the guidance for the control of *Listeria monocytogenes* in ready-to-eat foods

Part 1 provides a glossary of terms and information on the characteristics of *Listeria monocytogenes*, the sources, the consequences of food contamination and how it may enter the processing environment. It also provides information on a *Listeria* Management Programme (LMP).

Part 2 provides information on specific Good Operating Practices (GOP) that should assist in either preventing contamination of food with *Listeria monocytogenes* or managing the pathogen if present.

Part 3 provides information on microbiological testing for verification of the control of *Listeria monocytogenes* and how to respond if *Listeria* is detected in the processing area or in product.

Note that for small operations a condensed version of this document can be found in **Appendix 1: *Listeria* testing and sampling for a small operation**

Part 4 identifies the responses that should be made when *Listeria* has been detected in the processing environment, ingredients, raw materials or product.

3 Definitions

Definitions used in this guidance document can be found in Part 1: *Listeria* Management and Glossary.

4 Verifying the effectiveness of a *Listeria* Management Programme (LMP)

4.1 What is verification?

Verification is the activities that a food operator does to show that their programme is working, in this case the *Listeria* management programme. Verification is about avoiding unpleasant surprises. The surprise is finding that product has become contaminated even when *Listeria* control measures and good operating practices are in place, because these have not been effective.

A wide variety of tools can be used to verify the effectiveness of the *Listeria* control measures. Which of these will be most useful will depend on the nature of the product, the process and how it is packaged.

Tools may include:

- ingredient and raw material testing;
- confirming the effectiveness of cleaning and sanitation programmes by the use of indicator organisms, ATP, etc.;
- testing the process environment for the presence of *Listeria* (environmental sampling plan);
- shelf-life testing of product;
- product testing for the presence of *Listeria*;
- verification of the effectiveness of cleaning and sanitation through visual inspection;
- a visual audit of GOP, HACCP and supporting systems;
- an audit of suppliers specifications and requirements;
- confirming that critical limits have been achieved, e.g.
  - pH; or
  - water activity of a product, or
  - the time and temperature requirements for cooking, or
  - the time to achieve a drop in acidity or cooling, etc.

Note that the more tools that are used, the more effective the feedback is likely to be. The tools should be appropriate otherwise they may be a waste of time and effort.

Figure 1 provides an overview of the *Listeria* control tools critical to effective *Listeria* control in RTE foods with differing potentials for contamination to occur and for the growth of *Listeria* to occur. Where a number of RTE foods are produced in the same facility, the programme developed should focus on the foods that have the highest likelihood of the presence of *Listeria* including those foods that support the growth of *Listeria*.

4.2 Microbiological testing as a *Listeria* control tool

In Figure 1 there are three control measures that require microbiological testing to be undertaken. These are:

1. Ingredient/process control
2. Environmental testing
3. Product testing

Note that microbiological testing may also be conducted to verify the effectiveness of the cleaning and sanitation programme.

4.2.1 Ingredient/process control

A HACCP analysis of a product and process may identify that *Listeria monocytogenes* is a hazard reasonably likely to occur on incoming raw materials. Processing will then be required to reduce the number present to a safe level by removal and inactivation. For example, washing in water containing chlorine or by application of a listericidal process e.g. pasteurisation.

Operators need to demonstrate that the process is able to reduce the levels of the biological hazard present to a safe level. This may require testing of ingredients or raw materials to provide an assurance that the level does not exceed the reduction that the process achieves. For example if a process reduces the count by 3 logs, to have a final count of 'not detected' in 25g, the incoming raw materials should not exceed 10^3cfu/g. In this case the operator has several options for assuring that the levels in incoming materials do not exceed this limit such as:

- testing of a number of batches to establish a history of contamination levels;
- testing of raw materials by supplier before use to demonstrate that levels are acceptable;
- identification of events that could result in levels becoming elevated e.g. prolonged wet weather for horticultural products;
- regular testing programme to provide assurances that levels are within the acceptable range.

4.2.2 Environmental testing

An environmental testing programme is essential where there is the potential for RTE product to be contaminated with *Listeria*. Environmental testing means taking swabs from selected sites in the processing areas and getting them tested to see if *Listeria* is present. This helps to provide confidence that control measures such as good hygienic practices and the cleaning and sanitation programmes are being effective. *Listeria* are not visible to the naked eye and can be present even when surfaces appear visibly clean.

If *Listeria* is present, then the operator will need to respond promptly. The response will depend on the site where the positive result came from. The closer the site to the final product, the more intensive and rapid the response needs to be as the higher the risk will be that product has been or could become contaminated.

4.2.3 In-process testing

In-process testing is an additional tool that may be of value to food operators whose products do not have a listericidal process applied to them. This may be the only way of ensuring the effectiveness of a sequence of control steps to provide the required reduction of *Listeria.* This could apply in for example:

- manufacturing a raw milk dairy product; or
- a mixed vegetable salad; or
- foods made from a mixture of ingredients where there is no further listericidal step such as hummus or pesto.

Where a single listericidal process is applied, ensure the effectiveness of this CCP is monitored by adherence to the parameters assigned to the process, e.g. a set time and temperature.

4.2.4 Product testing

Product testing will contribute to providing assurance that controls are being effective where there is:

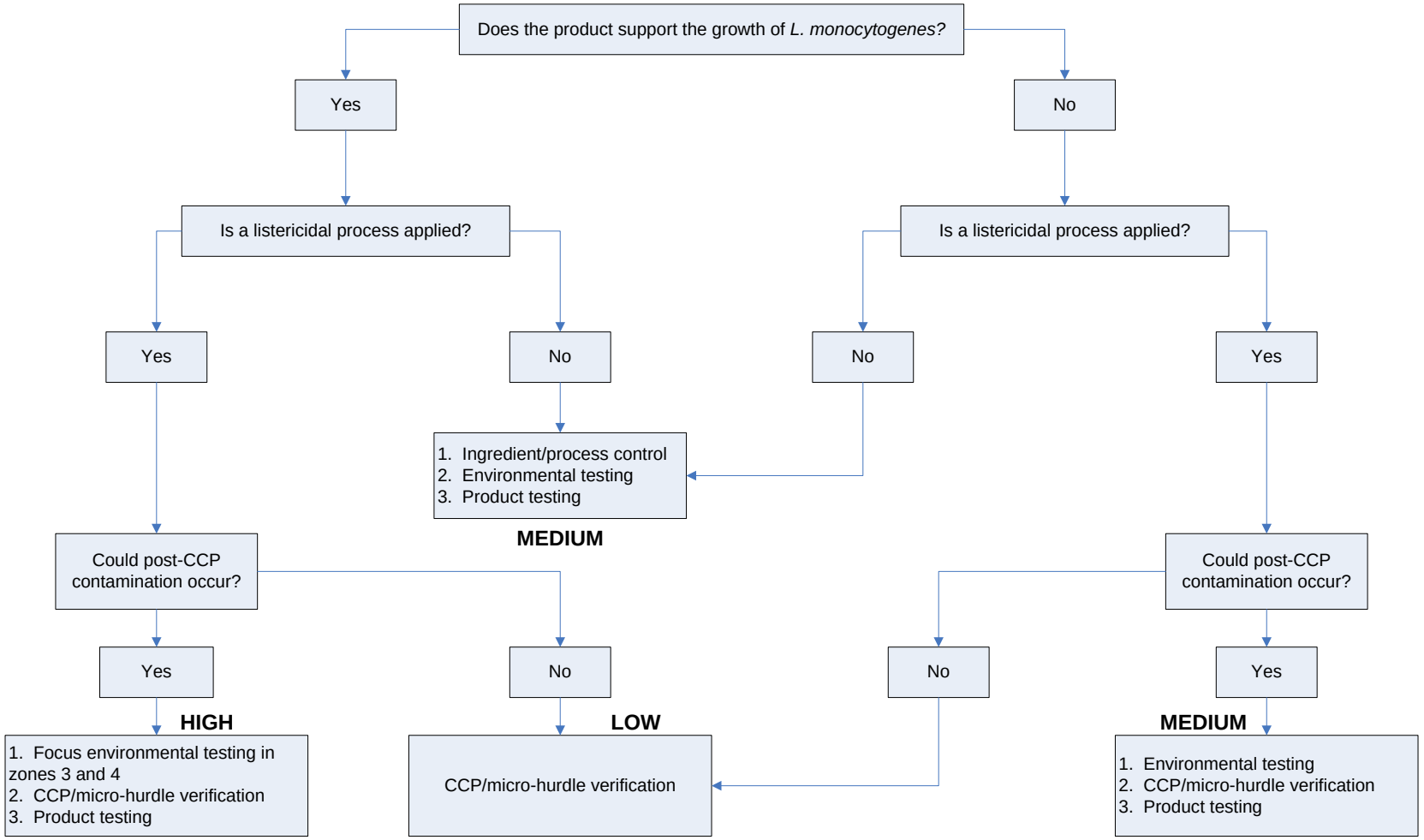
- the potential for product to become contaminated during processing; or
- not a listericidal process applied to the product in its final packaging.

4.3 The value of a good *Listeria* testing programme

A good *Listeria* testing programme will:

- give confidence that the processes applied to minimise, reduce or eliminate *Listeria* in the food are delivering the expected outcome;
- determine how effective the *Listeria* control measures are at keeping *Listeria* out of critical processing areas;
- sometimes give positive results; the detection of *Listeria* will help to identify corrective actions should be made;
- identify new problems by giving an early warning of a breach of the hygiene systems and barriers between each hygiene area The testing programme and corrective actions will identify the problem and direct actions towards the location of the site where *Listeria* is growing and/or contaminating product;
- allow a response to be made if *Listeria* is found, which should prevent product contamination occurring in the future;
- minimise the opportunity for breaches in controls caused by damage to buildings due to adverse weather, equipment breakdowns or changes to equipment, procedures or product processing and composition to lead to contaminated product;
- provide assurance as to the quality and safety of the product.

Figure 1: Selecting *Listeria* control measures depending on the potential for the presence of *Listeria* and/or growth of *Listeria*



5 Setting up a *Listeria* testing programme

5.1 Overview

Each *Listeria* testing programme will be unique to the operator and their premises.

When setting up the microbiological testing programme it is important to start with a good understanding of:

- the risks of contamination occurring and the *Listeria* controls that are in place;
- the potential for contamination based on the type of RTE product and process;
- whether there is a listericidal step;
- whether there is the opportunity for post-processing contamination to occur i.e. is the product exposed to the environment in the processing area prior to final packaging?

Factors that contribute to the potential for contamination include:

(1) How separation between raw and RTE food is managed, e.g. through the use of physical separation, separation by distance or separation by time, and the establishment of the hygiene zones. See Part 2 11.1.3 Physical separation.

(2) The process flow and whether this introduces the potential for cross-contamination to occur. In general, the more linear a process the less opportunity for post-processing contamination.

(3) The size of the processing area. Where the processing area is cluttered or busy there is a greater potential for cross contamination to occur.

(4) Movement controls that help to prevent *Listeria* getting into an area where product is exposed after the final listericidal process (e.g. cooking) for slicing, packing, etc.

(5) The design, maintenance and repair of the processing area and equipment. Old poorly maintained equipment and buildings may be harder to clean and may harbour *Listeria*. Similarly poorly designed process areas and equipment can introduce contamination

(6) Procedures that clearly define the process required to reduce *Listeria* to a safe level i.e. the validation of relevant *Listeria* control measures and any CCPs.

(7) Controls for ingredients and raw materials, e.g. supplier assurance programmes and specifications.

5.2 Documenting a *Listeria* testing programme

The *Listeria* testing programme will need to be included as a section of the overall *Listeria* management programme (refer to Part 1) and will include the following activities and information or a record of where they can be found:

(1) The person or position responsible for managing and running the programme.

(2) A sampling plan for the environment and product.

(3) Procedures for collecting environmental and product samples and situations where sampling should be increased.

(4) Training of samplers.

(5) The laboratory contracted to do the testing.

(6) Record keeping – for recording and reporting laboratory results and trend analysis.

(7) The response – an action plan for when *Listeria* is found and an increased sampling frequency or numbers may be needed.

(8) Review of the testing programme when there has been a contamination event or a change to product, processing, equipment, premises, etc.

5.3 Actions for managers

Managers need to understand the importance of *Listeria* testing for verification, its impact on food safety and of making the appropriate response to any result. Managers need to understand that *Listeria* is expected to be found from time to time in the processing environment and that the response (or action plan) is critical.

The failure of staff to report positive results and/or the managers to respond appropriately have contributed to:

- outbreaks of listeriosis; and
- product recalls (this may be some time later); and
- the loss of reputation for the company; and
- a great deal of expense.

Scenario setting, using fictional laboratory results for contaminated samples can be used to:
- see if the communication plans are workable; and
- that everyone along the production line knows and agrees with their roles and responsibilities; and
- ensures that nothing has been missed in the response plan.

5.4 Responsibilities – taking charge of the *Listeria* testing programme

The *Listeria* testing programme should identify a designated person and their deputies to take charge of the testing programme. Their responsibilities should be clearly identified for the implementation and ongoing activities related to *Listeria* testing. They should be able to be able to make decisions about the appropriate response to the results. A checklist of the different responsibilities is detailed in Table 1.

The designated person(s) should be available at any time to initiate corrective actions in response to that *Listeria* is detected.

There should be an agreed system to alert managers to the detection of *Listeria* during testing or of the failure of *Listeria* control measures.

Table 1: Checklist of responsibilities for the designated persons

The designated person should ensure that the following tasks have been completed	
TASK	**ACTIVITIES/INFORMATION TO BE RECORDED**
Contract with a laboratory	• Costing for tests • Frequency and types of tests • Arrangements to transport samples to the laboratory e.g. couriers and transport containers • Notification of the results (presumptive *Listeria* detected or confirmed result) • Arrangements for notification outside normal working hours
Sampling plans and schedules developed and documented	• Sampling sites identified • Timetable for sampling
Materials needed to take and transport samples are available (This may be delegated to the trained sampler.)	• Equipment and materials are available in sufficient quantity and not out of date when sampling is to be undertaken. (Equipment and materials may include sterile swabs, sterile sample containers, gloves, forceps and sterile liquids to moisten swabs.)

The designated person should ensure that the following tasks have been completed	
TASK	**ACTIVITIES/INFORMATION TO BE RECORDED**
	• Containers for transporting samples
Trained samplers to collect samples	• Ensure that all samplers are trained and competent • Ensure that there is a consistency in sampling technique, including knowledge of samples sites, sample coding
Determine and document the response to positive findings	• When the sampling frequency should be increased • Conduct trend analysis • Review of the testing programme at least annually
Management and processing staff awareness of the *Listeria* testing programme	• Ensure that staff including managers are aware of the importance of *Listeria* testing and responding appropriately

5.5 Training of samplers

Samplers should be trained to ensure that they are competent so that samples are taken consistently and relevant sample sites are identified. It is important that samplers understand why and how samples should be collected aseptically. Training records should be kept and reviewed so that only competent samplers are allowed to collect samples.

All aspects of the sampling process should be written down. The procedures include:

- where and when to sample; and
- sampling materials e.g. swabs, diluents, forceps, transport containers; and
- how to sample e.g. hygiene and gloves, area and equipment to be swabbed, sequence for taking samples; and
- how and when samples may be composited; and
- labelling samples and storage prior to dispatch; and
- documentation and transport arrangements; and
- the key contact at the laboratory.

Appendix 2 provides an example of how to label an environmental sample to ensure traceability from the sample to the result.

5.6 Laboratory contract

5.6.1 Contract

Having a contract with a testing laboratory helps to ensure that costs, reporting, sample transport and delivery arrangements are clearly understood and agreed.

Laboratories do not appreciate receiving samples without notice. They may also have preferences for which days routine samples are sent to them.

Discuss and agree with the laboratory the notification (reporting) procedures, i.e. at which stage during the testing process that the company should be alerted to the possibility that *Listeria* may be present.

The laboratory will be able to provide advice on most aspects of sampling and testing

5.6.2 Laboratory accreditation

The laboratory should be competent to do the test that is required, i.e. is ISO 17205 accredited. Being competent will mean that they are accredited to test the type of sample or food using an appropriate test method. It is important to inform the laboratory if a different type of food or sample from usual is to be tested as they may not be approved for this or have a suitable test method.

5.6.3 Communicating with the laboratory

It is important for the operator to have written procedures for communicating with the laboratory so that the laboratory know when and how many samples to expect for testing and who they notify when the results are available. This should include:

- the key contact at the laboratory;
- how and who should be contacted when the results are available. This may be more than one person;
- when they are open to receive samples and how long it will take for a result to be provided.

Ensure that you know how and who to contact at the laboratory if there is a problem or if testing needs to be arranged at short notice. This information should be easily located by the designated persons or managers, who could be called upon at short notice to respond to any *Listeria* problem.

The sooner that a food operator is aware of the possibility that *Listeria* has been found, the quicker that actions can be initiated to address any problems and minimise the amount of at risk product produced.

The process of finding and then identifying *Listeria* takes several days. The laboratory will be able to notify the food operator when they suspect they have found *Listeria* (a presumptive test result). As the testing process continues they should be able to provide an update on progress.

5.7 The environmental sampling plan

Each premises needs a customised environmental sampling plan.

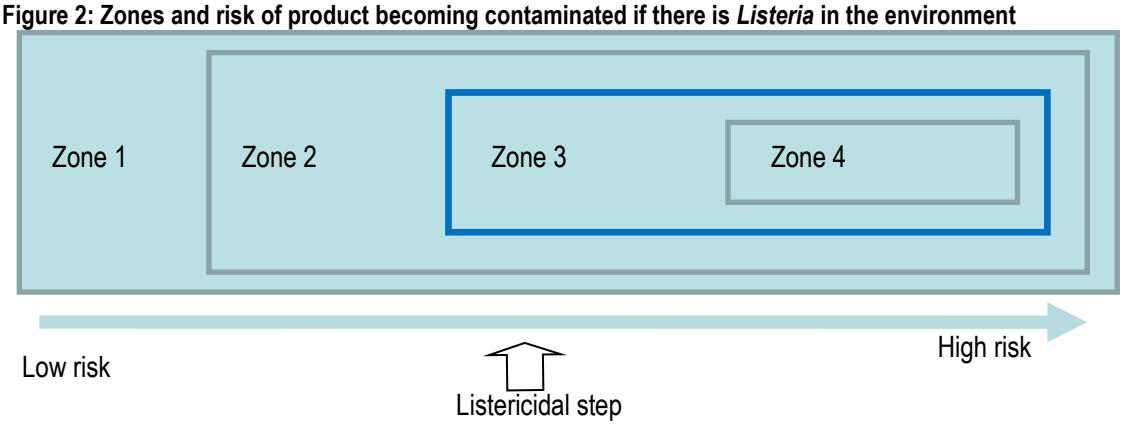
5.7.1 Identify sampling sites

A sampling plan will identify:

- the locations/sites in the process/production environment from which samples will be collected;
- the number of samples and the frequency at which each site is sampled;
- the type of sample, e.g. swabs of surfaces or materials such as scrap, sweepings or liquids.

If there is *Listeria* in the processing environment, the risk to product increases along the process chain, with the greatest risk being to final product which is exposed to the environment. This is illustrated in Figure 2. Reducing the risk is achieved by the application of GOP with the intensity increasing as the risk increases.

Figure 2: Zones and risk of product becoming contaminated if there is *Listeria* in the environment

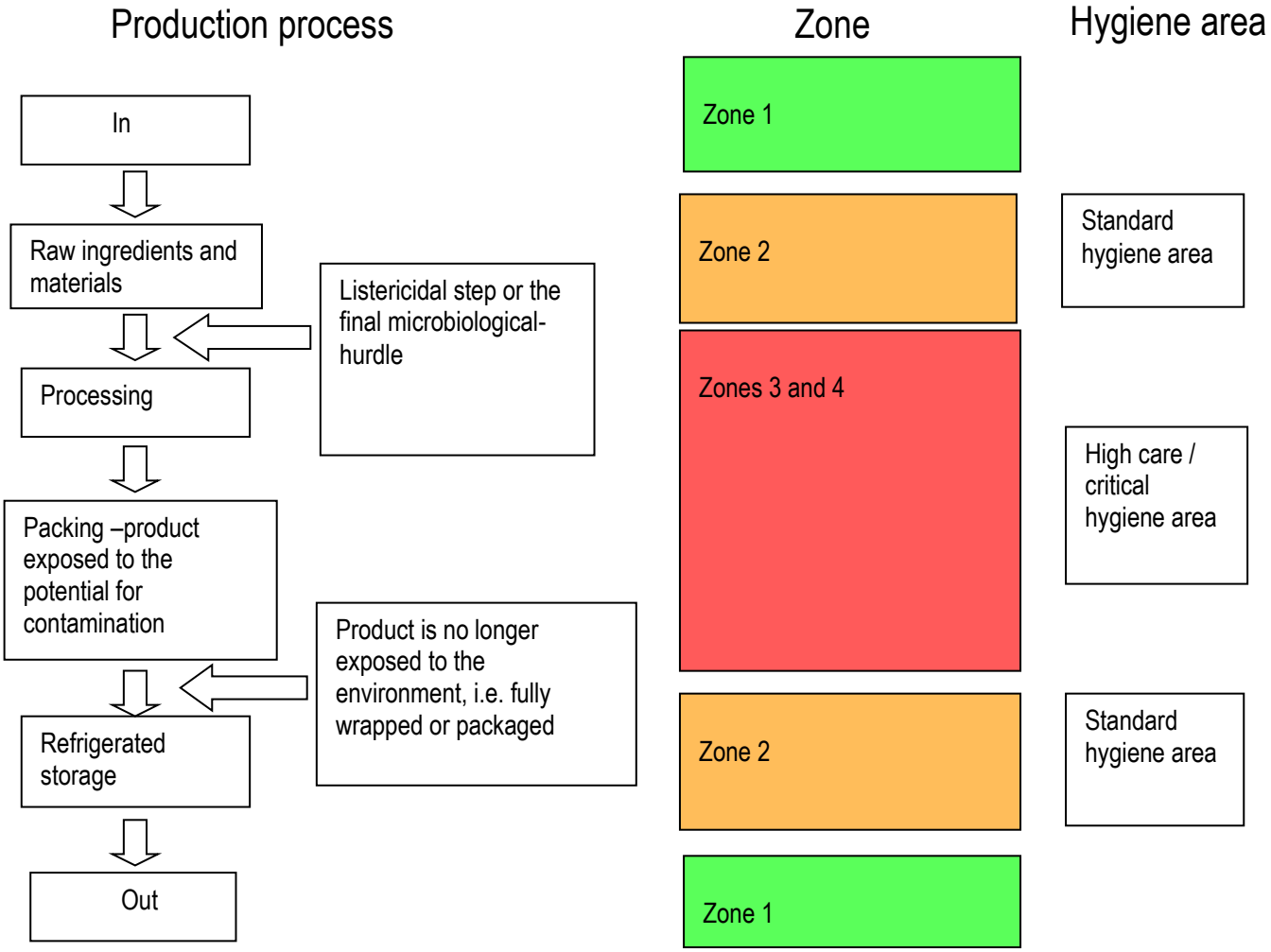


Key:

Zone	Definition	Action
Zone 1	low hygiene area	keep clean and tidy; remove clutter; don't allow build-up of dirt
Zone 2	standard hygiene area	clean and sanitise regularly; keep items off floor; don't use as storage area
Zone 3 and 4	high care/critical hygiene area	clean and sanitise at least daily; restrict access of people and equipment

As product moves through the processing areas the risk of environmental contamination will change. This is illustrated in Figure 3. Mapping product flow is an important tool to look at whether product is being put at risk by conflicting flows through an area. Ideally product flow should be linear with raw materials coming in at one end of the processing area and finished product leaving from the opposite end.

Figure 3: Product flow and hygiene zones



Sampling sites should be recorded. These can be marked on the floor plans of the processing area and/or a clear description of the site recorded to avoid confusion. A code may be assigned to each site for ease of sample labelling and identification of results. Anything and everything in a hygiene zone should be considered for sampling. This may include parts of buildings, access ways, equipment, forklifts, knives, gloves and door handles, etc.

Sampling should be risk based and should target potential sites where *Listeria* may grow and transfer points. These include food contact surfaces. Sample sites and the frequency of sampling will change over time depending on the results and any changes to the process and product.

Niches and harbourage sites are places where *Listeria* could become established. To be able to grow *Listeria* requires moisture, a temperature within its growth range and food. Food for bacteria means any organic material including food residues. An ideal niche is be somewhere that provides these essentials and that is difficult to clean or that is infrequently cleaned. Once *Listeria* is on a surface where growth is possible it may form a biofilm. Biofilms are difficult to remove and are resistant to chemicals.

When selecting sites consider the following:

- For **processing equipment** focus on:
  a) hard to clean areas (old, porous and/or damaged sites);

b) equipment that used more frequently;
c) damaged[1] equipment;
d) those sites where *Listeria* has been found previously.

This may include:

a) moving parts, valves, wheels on conveyor belts, seals (and areas behind and beneath seals), safety covers, cracks, ducts and on and in hoses and spray nozzles;
b) floors, especially if damaged;
c) seams and small gaps in equipment that is difficult or impossible to take apart;
d) chillers and refrigeration units that don't get cleaned often.

- **Choose sites to give the best chance of finding any *Listeria* that may be present** - be aggressive in finding contamination sites. This means taking many samples. Expect to occasionally find *Listeria*, especially in processing areas prior away from the high care area. Cracks and crannies should be looked for to test and so that maintenance could eliminate them as potential niches. Consider:

  a) drains, especially where water pools;
  b) areas where condensation collects and which are constantly wet;
  c) damaged or hollow components where liquid can accumulate;
  d) areas with poor drainage.

- **Correctly identifying Zone 4 sites is critical**. Product contact surfaces are potential direct sources of contamination after a listericidal step or the final stage of a microbiological hurdle process. If the food supports the growth of *Listeria,* any *Listeria* that may contaminate the food will be able to grow freely during the refrigerated shelf life of the product. Zone 4 sites that may be sources of contamination are product contact surfaces (e.g. conveyor belts, work tops, trays, knives, slicers and dicers).

  Where the product contact surfaces are inside equipment (e.g. liquid fillers), the opportunity to sample these internal sites may be limited and alternative strategies may need to be adopted such as targeted product samples taken at set points in the production run e.g. first and last 5 product units, every hour after commencement of packing.

  Note: These samples should be recorded as environmental sample results and would be in addition to the product testing requirements.
  Note: For some food industries there may be industry specific definitions for Zone 3 and/or Zone 4 processing areas, e.g. seafood and dairy, and specific required actions when *Listeria* is found.
- Further examples of potential niches are shown in Appendix 3. Once a niche is identified where *Listeria* could be present, consider the potential for it to be transmitted to other areas. Consider the movement of people, equipment, ingredients and raw materials and unfinished product within the premises and whether these may act as a possible vehicle for the movement of *Listeria*.

- **Look for potential transfer sites**. In general, potential transfer sites or transmission routes are where people, equipment, ingredients and unfinished products move within the premises. Focus on these when developing a sampling plan. Transfer points include:

  i) floors in high traffic areas;
  ii) pallet jacks and trolleys;
  iii) tools and handles, seals and pull cords for doors;
  iv) water – either liquid of aerosol (high pressure cleaners are a well-known problem)
  v) equipment that rotates, spins or moves;

[1] It is expected that damaged equipment will be identified for remedial action, refer to Part 2 Good Operating Practices.

vi) gloves;
vii) any difficult to clean surface.

Food contact surfaces can be both a niche (if damaged) and a transfer site:

i) work tops;
ii) trays;
iii) knives;
iv) slicers;
v) dicers;
vi) conveyor belts.

If **new equipment or new products** are introduced they should immediately be assessed for addition to the sampling plan. The sampling plan should also be adjusted in light of positive laboratory results to focus on sites where *Listeria* is isolated.

5.7.2 Sampling schedule

Table 2: summarises the reasons for sampling and testing the processing area within each hygiene zones

Table 2: Testing strategies

Hygiene zone description [1]	**Likelihood of product contamination if *Listeria* present**	**Why test?**	**How to identify sample sites**
Zone 1- Outside the processing areas May be outside the premises. Areas through which people and equipment pass e.g. loading bays, waste bins, storage areas, especially those used for packaging	Low	Finds *Listeria* lurking outside which could easily be brought into the processing area on feet, equipment etc. No need to test if this route is unlikely e.g. good entry barriers, dry and, clean building surrounds, no puddles, good pest management, no equipment or people moving through entrances into Zone 2	Identify sites, if any, which people, materials or equipment may come into contact with before entering processing areas Consider prioritising some for regular testing, other sites sampled at least quarterly
Zone 2 - Standard hygiene area Initial preparation and processing area e.g. cutting, dicing, washing including the equipment and areas where packaged product is stored	Low - if there is a CCP designed to inactivate pathogens later. M Medium/high if no CCP. The consequence of contamination will depend on whether the food supports growth of *Listeria* and the shelf-life of the product	Shows if *Listeria* is coming into the processing area and tests the effectiveness of cleaning and sanitation. Find it here before it moves into high care areas. Will be important area to test if there is no CCP for *Listeria*	Identify sites from which *Listeria* could be transmitted to the food e.g. drains, condensate pools, hoses, conveyor belts, walls, floors, processing equipment. Consider prioritising some for regular testing, other sites less frequently
Listericidal process i.e. CCP or micro-hurdles all operating			
Zones 3 and 4 – Critical /high care hygiene areas	High - if food is not processed in the final packaging	Food subjected to a listericidal process is very vulnerable to	Include all sites every sampling cycle

Hygiene zone description [1]	Likelihood of product contamination if *Listeria* present	Why test?	How to identify sample sites
Main processing and the post-processing areas where further handling occurs e.g. slicing and packaging, final addition of ingredients, filling		recontamination. Lack of competitive bacteria allows *Listeria* to grow. Product contact surfaces and equipment in contact with the food may become contaminated. *Listeria* can be introduced from standard hygiene areas	

[1] Zones are ideally separated by physical barriers such as walls but in small operations this may be indicated only by markings e.g. red line on the floor, change in floor colour, or through separated by time (refer to Part 2 Good Operating Practices).

Sampling may focus on critical/high care hygiene areas if there is a high degree of physical separation e.g.:

- physical barrier with boot and clothing exchanges;
- between the standard hygiene zone and the critical/high care hygiene areas (Zones 3 and 4).

An example of a sampling plan for a small operation without physical separation is discussed in Appendix 1. For larger operations, the sampling plan will be more complex.

The frequency and the number of samples taken in each zone should relate to the size and complexity of the operation, the products and the process. Sampling schedules are usually based on a yearly cycle with samples being collected at regular intervals during the year. The interval between these routine sampling rounds may vary from a day to a week to months. Some sites, especially product contact surfaces may be sampled every time but other sites less frequently.

Hint: Use a calendar format to schedule sampling rounds and a spreadsheet with colour coding to show when a site is to be sampled.

The number of samples collected each time will vary according to the range of the products, the likelihood of *Listeria* contamination and whether the food supports the growth of *Listeria*. The recommended minimum sampling regime for small operations or where low risk RTE foods are being processed is no less than 5 environmental samples plus 5 product samples.

Samples collected from the same hygiene zone may be composited, refer to 5.8.

Any testing conducted is expected to verify that the existing *Listeria* control measures are operating as intended and to reduce the potential for contamination of *Listeria* in product. Microbiological testing is a verification tool and it is important that any testing provides meaningful results. Businesses that find the level and cost of testing too burdensome should consider firstly why it is too costly. Is it because *Listeria* is being found requiring a response, a large product range, poorly designed programme or other reasons?

Look at ways to reduce the likelihood of *Listeria* contamination (refer to Part 2 Good Operating Practices) and operator verification of these. Other options may be to reformulate the product so that *Listeria* will not grow or to treat the product after processing, e.g. by applying a heat treatment to packed product, or even whether the particular product or line should be in operation.

5.7.3 Situations where sampling frequency or number of samples should be increased

There are a number of situations where an increased sampling frequency or number of samples collected is required or advisable. This may be because the *Listeria* controls may have been compromised or have failed (see Table 3) or where a new product, process or piece of equipment has been introduced or there have been other changes.

The sampling rate or frequency may be returned to normal once it has been shown that the situation is no longer having an impact. It is, however, important to continue increased sampling for sufficient time to have confidence that the system is under control. For example, at least three sets of negative results at the increased rates after a change to a cleaning and sanitation programme.

Table 3: When to increase sampling

Situation	Response
Start-up of new facility or processing line	• Decreased time between sampling e.g. weekly instead of monthly • Increase number of samples from high care areas and product contact surfaces • More frequent product samples e.g. every batch rather than weekly or monthly
New product formulation, packaging or process	• Increased product samples i.e. more samples each time or more frequent sampling for the first month
Changes to cleaning procedures, chemicals and equipment	• Increased samples from affected hygiene areas and affected downstream processing areas
Building or equipment repairs, maintenance, alterations – scheduled or unscheduled	• Increased samples from affected hygiene areas and affected downstream processing areas • Extra samples from affected equipment
Environmental disruption e.g. flood, roof damage	• Increased samples from affected hygiene areas and downstream processing areas • Sample more frequently until evidence that no impact or impact remedied • Extra samples from any affected equipment
Increased production for a defined period e.g. longer work days, more work days (bigger product volumes and altered cleaning schedules)	• Increase product samples • Increased testing of cleaning and sanitation and cleaning especially if schedules are changed or potentially compromised by production demands
Listeria has been found in Zone 3 (non-product contact surfaces in the high care area)	• Repeat sampling of site immediately • Continue intensified sampling of positive site until at least 3 clear results • Consider taking additional samples from sites adjacent to the positive site or which could be affected by the site
Listeria has been found in product or Zone 4 (product contact surfaces and related sites)	• Refer to Part 4: Corrective Actions

5.8 Environmental samples

5.8.1 How to collect environmental samples

Before commencing sampling, ensure that you have:

- the sampling plan;

- a sampling kit containing sterile swabs, sterile containers for the swabs, permanent marker pens to label the swabs, diluent to moisten swabs if needed.

The aim of sampling a surface is to extract as many bacteria as possible. This is done by rubbing a damp, sterile swab firmly over the surface to pick up any *Listeria* present.

When collecting samples from the process environment consider *Listeria* as a fish and look in the areas that you know it likes to lurk, moist areas, nooks and crannies, areas that are hard to clean, etc. and use a swabbing technique (the bait) that is more likely to trap *Listeria*. If *Listeria* is present in a biofilm they will be harder to be picked up with a swab and may require more physical effort, i.e. use swabs and metal forceps and give it some elbow grease.

The techniques used to sample should be written down and staff trained to ensure that there is consistency in sampling.

- Swabs of different types are available commercially and the sampling plan must identify which to use at each site.
    - Gauze swabs and forceps is an effective way to pick *Listeria* up from surfaces as they can cover a greater surface area, a large amount of pressure can be applied and it is easier to composite samples.
    - Commercially available swab kits may be more appropriate for small operations who do not have technical staff.
    - Swab sticks may be useful for getting into cracks and crevices and for complex equipment.
- If commercial swabs are used follow the supplier's instructions.
- Sanitise the sampling equipment before bringing it into the processing area to prevent introducing contamination.
- Write sampling instructions down e.g. using tongs or gloves; what to do with the samples once collected i.e. labelling and preparation for transport to the laboratory.
- Commence sampling in the critical hygiene (high care) area and move progressively out to the standard hygiene areas – the lower risk areas. This helps to avoid introducing contamination from the standard hygiene areas.

Environmental samples may also include materials such as sweepings, scrapings, rubbish, samples from puddles, pooled water and product scrap material. It can also include things, for example green pot scrubbers, bits of hoses, trolley wheels, conveyor belts, aprons, gloves which can be useful during an investigation to determine the source of contamination.

Samples from the same zone may be composited (combined to make one test sample) to reduce test costs. However it is preferable that only swabs from similar or the one site are composited e.g. swabs from several aprons, multiple swabs from a large piece of equipment. Swabs from different zones should never be composited together.

5.9 When to take environmental samples

Samples can be taken at different times.

- **Prior to start up**: these samples verify cleaning and sanitation and are expected to be negative. Do not take environmental samples to verify the *Listeria* Management Programme at this point unless the equipment is switched on and allowed to run empty for a few minutes before sampling. Contamination from growth niches in equipment is often invisible and unable to be detected until the equipment is operating.

- **During operation**: collect environmental samples during the processing day at least two hours into processing to give *Listeria* a chance to work its way out of equipment. Do not collect samples after cleaning and sanitising. To take samples from inside equipment wait for a break or until the equipment can be dismantled.
- **At the end of operation**: some food operators find that taking samples at the end of the processing day very useful.

If there is more than one shift operating, then these need to be included in the sampling plan.

When equipment or lines are not in use they should still be sampled but at a reduced frequency.

Seasonal production: Where a processing operation is seasonal, e.g. production of Christmas hams, sampling is not appropriate until the facility and equipment re-commences processing. Samples should be taken during processing to show if *Listeria* is being introduced or if normal processing is disturbing *Listeria* niches which could contaminate the product. This gives time for bacteria that were trapped to work out onto surfaces. This is especially important for product contact surfaces.

Intermittent processing[2]: where RTE products are processed intermittently, i.e. on a weekly or monthly basis, then the sampling plan needs to be set within the context of the nature of the product, the process and any risk based measures.

5.10 Product sampling plan

Microbiological testing of finished products can be used by the operator to verify:

- the effectiveness of good operating practices and process controls; and
- compliance with the product safety requirements in the Australia New Zealand Food Standards Code (the Code).

When establishing the product sampling plan consider:

- the number of samples collected;
- the frequency of sampling;
- the type and number of products that are sampled;
- the number of batches and be flexible enough to respond to new products and the detection of *Listeria*.

Product samples to verify that the *Listeria* controls are working should be taken at the end of processing when the product has been packaged. Other samples can be sent at the end of the product shelf-life but this does not verify that the controls are working and if *Listeria* is detected then it is too late to be able to take any meaningful corrective actions.

5.10.1 How many product samples?

Ideally a minimum of five similar product samples should be sampled for laboratory analysis each time. It is possible for the laboratory to analyse a composite or pooled sample (see below) when conducting presence/absence testing provided that the method has been shown to be robust. To demonstrate

[2] Intermittent processing means processing that occurs from time to time or is periodic and not more than four days processing in any working week. For example, two days during the 1st week, one day the 2nd week and three days the following week, etc.

compliance with microbiological criteria such as that contained within the Code, the number of samples needed is 'n' and will be no less than five.

Experience gained through past *Listeria* incidents has shown that the fewer samples that are collected for analysis the lower the likelihood of finding *L. monocytogenes*. Think of it like fishing, *Listeria* can be a rare fish and if you want to catch one consider the difference between casting five hooks (or nets) or a single one. By casting five you are literally casting your net wider and should have a better chance of finding that fish or *Listeria*.

How you collect the sample is also important, again consider fishing where to catch the desired fish you need to be in the right spot with the right bait on the line. *Listeria* is the same; it is just that your bait is slightly different.

When sampling products, it is possible to reduce the likelihood of finding *Listeria* which is what you do not want when verifying the effectiveness of the *Listeria* control measures. For example, product may be tested for a number of different reasons, e.g.
1) to show whether a CCP has been effective; or
2) to show whether recontamination with *Listeria* has occurred.

For example 1, a core sample of a whole ham may be submitted to show that the cooking process has been effective. However, this would not provide any information about whether the surface had been subject to contamination.

In example 2, the product sample should include a portion from the surface to:
- provide information about whether recontamination of the ham has occurred; and
- determine whether *Listeria* control measures are effective.

Another example is where samples of a mould-ripened soft cheese are submitted for analysis. Two separate lots of samples may be submitted, one for water activity and pH and the second for bacteriological testing. The area of the product closest to the surface should be submitted for the bacteriological analysis as the acidity and water activity are more favourable to the growth of *Listeria* if post-processing contamination had occurred. The sample from the centre of the cheese should be submitted for chemical analysis as the use of heat treated milk and the cheese making process should have removed any harmful bacteria present.

5.10.2 Selecting product samples

Ideally the five samples should be from a single batch of product produced on any day. Alternatively samples from different products made on a single process line may be combined. A disadvantage of the latter approach is that in the event of a positive result it will need to be assumed that all of the products are contaminated.

Try not to combine different product lines together into a single composite sample for analysis, for example combining products in which *Listeria* will grow and those in which *Listeria* cannot grow, or combining products that are exposed to the processing area or receive a lot of manual handling with those products that are processed in a closed and protected environment.

For continuous processes, automated sampling may be more appropriate. Auto-sampling may be performed on liquids and powders. Small samples are taken automatically by a sampling device over a specified time period. By the end of the sampling period the required sample volume or weight will have been collected for submission to the laboratory.

Product samples (i.e. final packaged product that can be linked to the site and time of sampling) could be collected at the same time as product contact surfaces are sampled. In the event of either sample-type being found positive for *Listeria*, the task of working out the appropriate response will be made easier.

5.10.3 Which products?

Where there are a number of different products and lines, it may not be practical to test all of them during each sampling round. Instead decide which foods should be sampled and when. This could be done through random sampling, a rotating plan that includes all products over a set time period or according to the volumes produced. Focus on the RTE foods that have a higher likelihood of the presence of *Listeria* such as those foods which have been a concern previously or are more susceptible to post-processing contamination. Make sure that each sampling cycle includes products that have been processed on each of the processing lines from which product contact surface swabs have been taken.

5.10.4 How much to sample?

Ask the laboratory. They will usually require that each individual sample is at least 100g. Each test will usually use 25g, the rest of the sample will be available as a retention sample if additional or repeat sampling is required. The products should be submitted in their final packaging. If samples are needed to be taken from bulk product, this needs to be done aseptically immediately prior to the final packing step into individual sterile containers. The person doing this must be appropriately trained. Where final product is in units of less than 100g, multiple packages from the same batch may need to be submitted to the laboratory to give the required weight.

5.10.5 Frequency of sampling

When setting up a new product sampling plan RTE foods should be sampled more frequently than in an established programme. For example, an operator may sample RTE foods at a rate of at least one sample per fortnight for the first three months of an RTE food is produced. If *Listeria* has not been detected during this phase the operator can then move to sampling at a rate of once every three months.

5.10.6 When to take samples

Product samples should be taken when the RTE food is in the final packaging. If food samples are collected for analysis prior to the food being packaged this is not representative of the entire process as the foods could contaminated during packaging. However such samples may be part of process control (see section 4.2.3).

6 Record laboratory test results and trend analysis

Laboratory results should not just be read and filed away. Sampling and testing costs money therefore it is important to do something with the results. Put in place a system to be able to visualise and review the results easily. Table 4 provides an example of a spreadsheet that was created to enter the results from environmental testing. A similar spreadsheet can be created for product test results. By presenting the results in this way it becomes much easier to review and identify trends or patterns that may be occurring.

Trend analysis is a way of reviewing past results to try and predict whether a trend exists. This allows the food operator to make a response before the situation, in this case the *Listeria* contamination, gets out of hand. For example, *Listeria* may be found in certain areas of the premises or in one particular product or processing line. The food operator is then able to respond (see Part 4) and may review GOP (movement of people and equipment, the source of ingredients, etc.) and process controls to prevent any future reoccurrence.

Keep records of the *Listeria* testing that is undertaken including any actions taken as a result of such testing, e.g. amendments to process controls or GOP, or the review and updating of sites targeted in the sampling plan. Keeping detailed notes and observations is very useful if *L. monocytogenes* is detected. These records can reviewed once the contamination event is under control to determine which actions what worked or didn't and what could be changed in future. These records can be useful to show external agencies once the situation is under control.

Table 4: Example of a record sheet for recording results of sampling

Sampling Site	Zone	13th Jan	20th Jan	27th Jan	3rd Feb	10th Feb	17th Feb	24th Feb	3rd Mar	10th Mar
Bulk Bag Pallet	2	0			0			0		
Chiller Door Handle	2	0			0				0	
Chiller Floor	2	0				0			0	
Chiller Drain	2	0				0			0	
Chiller Wall	2	0				0			0	
Forks of Forklift	2		0			0			0	
GR Floor	2		0			1	0			0
GR Coving	2		0				1	0		0
GR Drain	2		0				0			0
GR Wall	2		0				0			0
GR Hose	2			0			0			0
Grader Framework	2			0				0		
Grader Belt	2			0				0		
Grader Belt Rollers	2			0				0		
Entry over Belt into HS Room	2			0				0		
HS Room Floor	3	0			0				0	
HS Room Drain	3	0			0				0	
HS Room Wall	3	1	0			1	0		0	
HS Room Hose	3	0				0			0	
HS Cooker Belt	3	0				0				0
HS Cooker Belt Rollers	3		0			0				0
Entry over Belt into OR	3		0			0				0
OR Floor	3		0				0			0
OR Coving	3		1	0			0			0
OR Drain	3		0				0			
OR Wall	3			0			0			
OR Hose	3			0			0			
OR Table Framework	3			0				0		
OR Table Underside	3			0				0		
OR Table Bottom Belt	3			0				0		
OR Floor Mat	3				1	0		0		
Water Bath Hood / Frame	3				0			0		
Water Bath Framework	3				0				0	
OR Cooker Exit Belt	4	0	0	0	0		0	0	0	0
OR Table Belt	4	0	0	0		0	0	0	0	
Opener's Knife	4	0	0		0	0	0	0		0
Opening Chute	4	0		0	0	0	0		0	0
Water Bath Belt	4		0	0	0	0		0	0	0
Pre-Freezer Grading Belt	4	0	0	0	0	0	0	0	0	0

Key:

0 = *Listeria* not detected (negative or absence result)	1 = *Listeria* detected (positive or presence result)
OR = Opening Room	Zone 2 = Standard Hygiene area
GR = Grading Room	Zone 3 = non-product contact surface - High care area
HS = Heat Shock	Zone 4 = Product Contact Surface - high care area

Note: By entering the results as a series of 0s and 1s for either a positive or negative result it becomes very clear if there are problem areas. Highlighting the positive results will assist this further.

The highlighted entries on the table show a possible cluster of contaminated sites on the floor of the grading room (10th and 17th February):

- Could one be the source of both contaminations?
- Is there surface damage that could allow the *Listeria* to become established?
- Could the contamination have come from an external source? If so how could it have been introduced? Repair if appropriate. Resample. Clean and resample. Sample nearby sites.

Appendix 1: *Listeria* testing and sampling for a small operation

6.1 Introduction

Testing for *Listeria* in the processing area and product is very important for demonstrating that the control measures in the *Listeria* Management Plan are working. When monitoring the processing area for *Listeria*, it is usual to test for any sort of *Listeria* in general. This may be shown on the laboratory report as *Listeria spp*. finding any sort of *Listeria* is a useful indication of how effective the *Listeria* controls are and will cost less. However, when testing product, the tests need to identify which type of *Listeria* is present as only *Listeria monocytogenes* (*L. monocytogenes*) is harmful. The laboratory will report this as *L. monocytogenes* confirmed.

For a small operation, the entire processing area may be considered as the high care area where there is no physical separation between raw and RTE products. Various activities and objects, including the ingredients and raw material used may provide the opportunity for *Listeria* to be introduced into the operation and the final product.

While testing product will not give you confidence that all product is free of contamination (you would need to test everything you produce for that to be true), it does show that your control measures and process controls are functioning effectively. A RTE food that has been processed properly e.g. cooked, should not have any *Listeria monocytogenes* present. Standard 1.6.1 in the Food Standards Code states that *L. monocytogenes* should not be detected in high risk RTE foods.

6.2 How to set up an environmental and product *Listeria* testing plans

6.2.1 The basics

Sampling and testing costs money so you need to make sure you are getting good value by doing enough to be meaningful and show that the *Listeria* control measures are working.

High risk products can become contaminated with *Listeria* from any surface to which they are exposed e.g. benches, knives, slicers, bins. These are product contact surfaces and contamination in these sites could result in product becoming unsafe. Product contact surfaces will often have become contaminated from some other sources of *Listeria,* such as damp areas on floors, drains, damaged areas anywhere in the processing area or equipment where dampness and food debris allows them to survive and grow. These are called non-product contact surfaces.

Finding *Listeria* on non-product contact surfaces before it can move on to product contact surfaces is the best way of preventing the *Listeria* contamination of product. The bacteria can be brought into and moved around the processing areas on footwear, clothing, trolleys, hands, equipment and tools, etc.

6.2.2 Sampling plan

Have a plan, so that you and your samplers know when, where and how to take samples and how the samples are sent to the laboratory for testing. The overall sampling plan should include:

(1) A contract with a laboratory for doing the tests and for reporting results to you.

(2) What equipment is required for collecting samples, labelling them and transporting them to the laboratory.

(3) The names of trained samplers.

(4) Plans for when and where samples are collected from within the processing area.

(5) Plans for when and where product samples are collected.

(6) How the laboratory test results will be recorded. Put the results in a way so that you can see any patterns that may occur (good and bad).

(7) Have a plan for what you will do if *Listeria* is found.

6.2.3 When should the environmental samples be collected?

There are three key questions when it comes to setting up a testing plan and these are:

(1) Does the cleaning and sanitation process ensure that the processing area is free of *Listeria* before production starts each day? Any testing here is part of the pre-operation checks and **is separate and not part** of an environmental testing programme for *Listeria*.

(2) Are the *Listeria* specific control measures including process controls working to prevent *Listeria* from contaminating the area where the RTE product is prepared, i.e. in the retail, chillers, preparation and packing areas from where it could get on to the product? Samples from the processing area should be **collected during operation** as part of the environmental sampling plan.

(3) To identify whether any corrective or preventative actions are needed and whether they are effective.

6.2.4 Checking the effectiveness of the cleaning and sanitation programme

Checking that the cleaning and sanitation programme is working well is important but there are cheaper and quicker tests that can be used than testing for *Listeria*. Start by ensuring that all surfaces are visually clean and there is no build-up of grime and product residues on hidden away areas.

There are several different types of tests that can be used to check cleaning including:

(1) APC (aerobic plate count) – This is a count of all the bacteria that are living on any surface. The sample is usually collected using a swab and can be from a set area using a template. If the cleaning programme works well the number present should be very small. If the same amount of surface area is sampled each time, then you can see if the cleaning is being less or more effective. Results should be recorded in a way so that it is easy to see what is happening e.g. as a graph.

(2) ATP or protein – there are a variety of commercial kits that can be used to track how much protein, including bacteria remains on a surface after cleaning. These tests may be 'real time' which means you get a result immediately and don't need to wait for the results to come back from the laboratory.

6.3 How to set up an environmental sampling plan

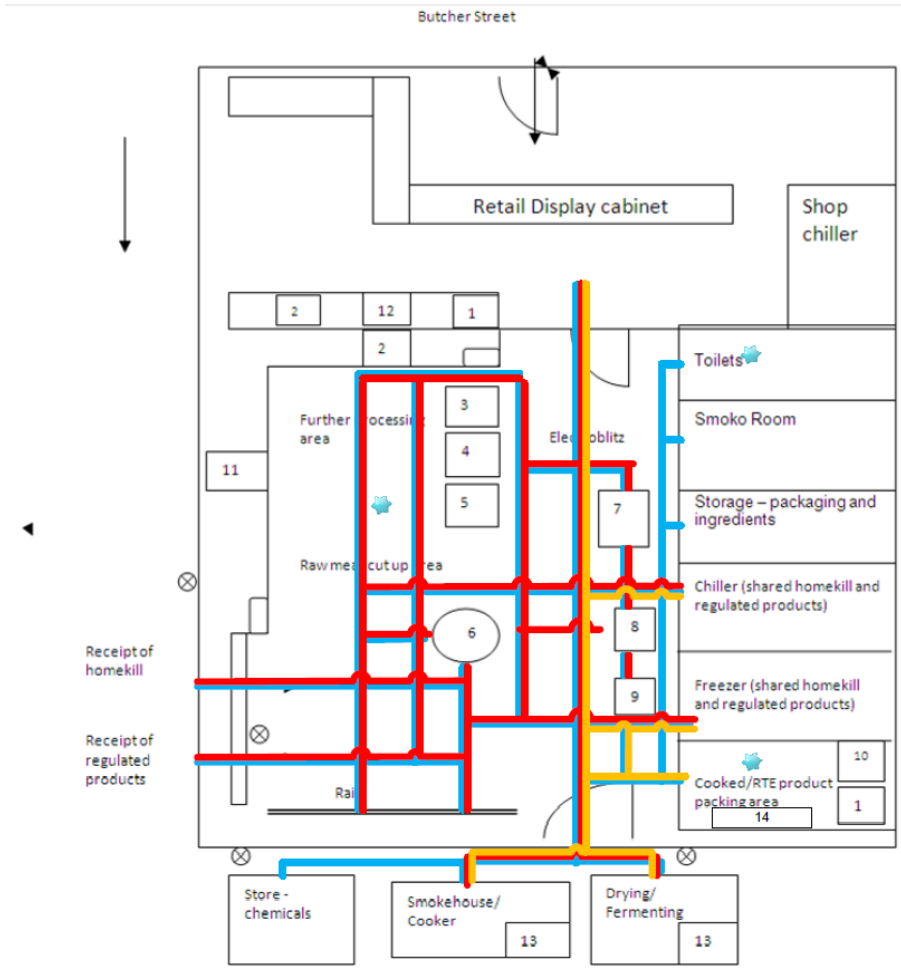
Step 1 - Pathway mapping

Sampling should target sites where *Listeria* could be present and transfer points; transfer points are areas where there is a high potential for *Listeria* to be move from one location to another.

To help you identify the transfer sites, map the pathways that people, equipment, ingredients and unfinished product take and identify high traffic areas on your site plan. Common niches and harbourage sites include damaged surfaces, pierced or hollow components, seams and small gaps in equipment that are difficult or impossible to take apart or areas with poor drainage where water accumulates.

Figure 5 shows how pathways can be mapped onto a site plan

Figure 5: Example of how pathways can be mapped onto a site plan



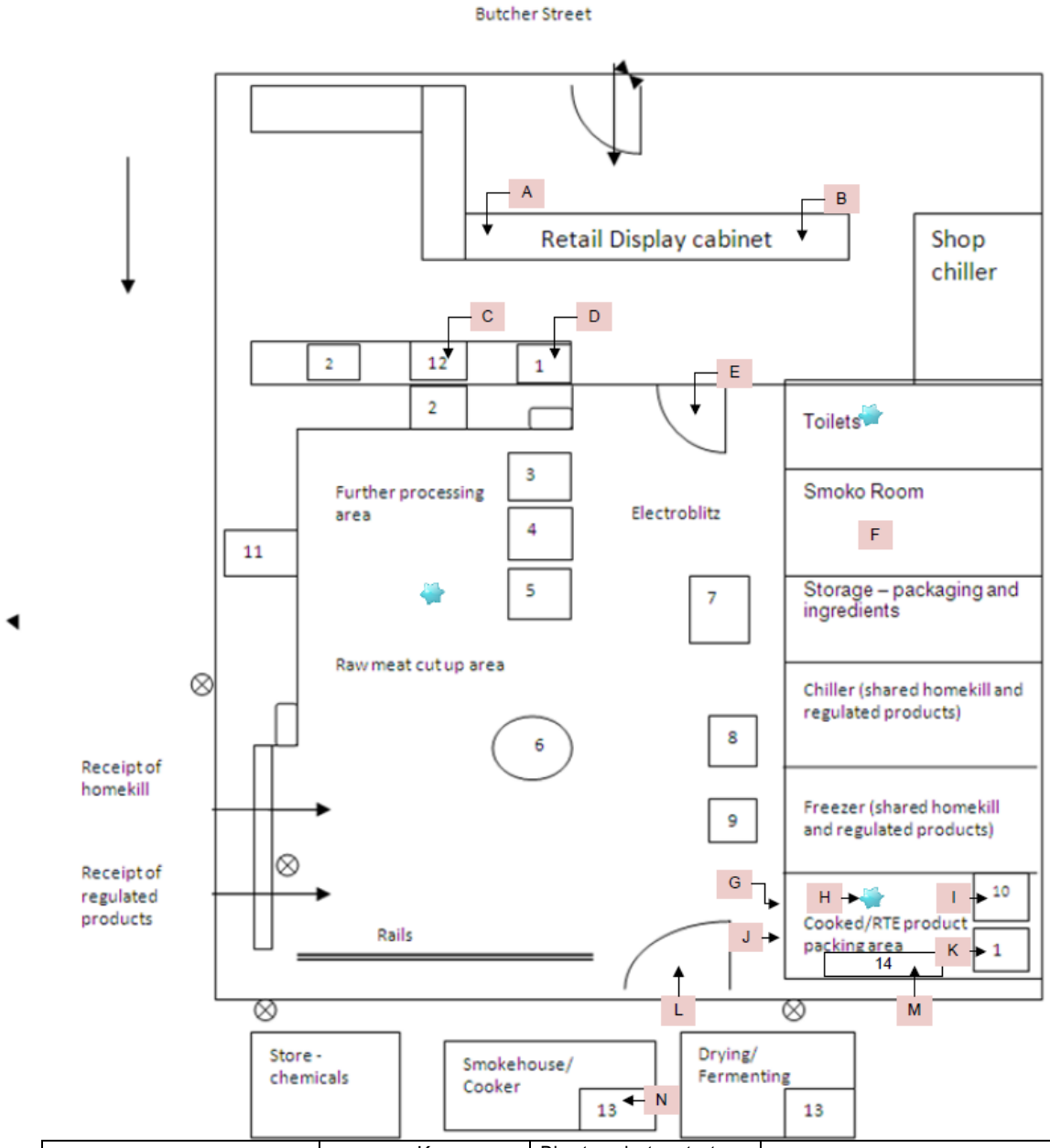
Equipment

1. RTE Slicer a & b
2. Raw Slicer a & b
3. Mincer
4. Bowl chopper
5. Sausage filler
6. Bandsaw
7. Brine Bath
8. Water cooker
9. Cooling Bath
10. Vacuum packer
11. Raw Scales
12. Shop Scales
13. Trolleys
14. Bench

Step 2 – Identify possible sampling sites

Identify places where *Listeria* may be present including product contact surfaces or non-product contact surfaces.

Look at the sites identified and decide which are the most important to sample for both product contact and non-product contact surfaces. Once *Listeria* enters the processing area, there will be many places it can grow and contaminate product. When taking swabs, be sure to include sites where floors are damaged, damp accumulates, including chillers and where equipment is bolted. Wheels of trolleys are often an easy way for *Listeria* to be moved around.



Equipment	Key	Direct product contact surfaces	Non-product contact surfaces
1. RTE Slicer a & b 2. Raw Slicer a & b 3. Mincer 4. Bowl chopper 5. Sausage filler 6. Bandsaw 7. Brine Bath 8. Water cooker 9. Cooling Bath 10. Vacuum packer 11. Raw Scales 12. Shop Scales 13. Trolleys 14. Bench	⊗ Bait Station Drain Sample Point	A Trays B Tongs D Slicer K Slicer M Cutting board O Knives Worktops	C Scales E Floor F Aprons G Door Handle H Drain I Vacuum packer J Floor (high-traffic area) L Floor (high traffic area)

			N Trolley wheels Gloves Worktop frame Light pulls/switches

Step 3 – Document the sampling plan

The sampling plan needs to include the following:

(1) **How often?** Swabbing is performed monthly. Priority can be given to some sites so that they are sampled more regularly than others. Make a table showing which sites are to be tested each month. The sampling plan should be adjusted to correspond with production. So if some high risk products are not being produced regularly but are seasonal, occasional or on certain days of the week, adjust the sampling plan to make sure you have these processing times included.

(2) **When to sample?** Show in the plan when sampling is to be done i.e. pre-operational or during processing. Note that the presence of sanitiser residue can interfere with tests, so surfaces should not be sampled until the specific contact time for the sanitiser has elapsed. The contact time should be specified in the cleaning procedure or the directions for the use of the sanitiser. Contact times in the range of 5 to 15 minutes are common.

(3) **Which swabs can be combined (composited)?** Up to five swabs taken from similar equipment or locations may be combined and tested as one i.e. a composite sample. For example, several aprons could each be sampled with separate swabs which are then all put in one sample bag and sent to the laboratory as a single test. This composite sample may give you a lot more information than single swabs for a small increase (extra swabs) in cost.

Example of a sampling plan where processing of high risk RTE products is ongoing

Site Shaded sites are pre-operational	January July	February August	March September	April October	May November	June December
Product contact sample sites						
A. Trays	X			X		
B. Tongs	X			X		
D. Slicer	X			x		
K. Slicer		X			X	
M. Cutting board		X			X	
Knife		X			X	
C. Scales			X			X
RTE food Worktop			X			X
N. Vac. packaging machine			X			X
Non-product contact sample sites						
Light switches	X					
E. Floor		X				
F. Aprons			X			
G. Door Handle				X		

Site Shaded sites are pre-operational	January July	February August	March September	April October	May November	June December
H. Drain	X		X		X	
J. Floor						X
L. Floor		X				X
N. Trolley wheels					X	
Worktop frames				X		

In this example, drains have been prioritised and so tested more frequently than other sites. This is the lowest sampling rate acceptable. More samples would give greater confidence that controls are working. It is recommended that slicers are tested every month.

Notes

(1) For product contact surfaces this plan ensures that each individual site is sampled at least once each quarter.

(2) In the example, priority has been given to the slicers and they are being sampled monthly.

(3) For non-product contact sites, priority has been given to the drain site and it is sampled monthly.

(4) Sample sites can be reviewed and changed.

6.4 Collecting environmental samples

Write down the procedure for collecting samples, labelling them, completing the laboratory submission form and transporting the samples to the laboratory

For surfaces a sample area of 1,000cm^2 is reasonable and you should swab a wide range of areas where contamination may be found, including under or behind equipment. Things and material such as scrapings, floor sweepings and bits of equipment to the laboratory for testing. This can be especially helpful when there is a contamination problem. It is a good idea to discuss any unusual samples with the laboratory before you collect the samples, so they know what to expect and are able to do the tests.

6.5 Product sampling

As a guide, test RTE foods at least once every month. If a number of high risk foods are processed then check that each product is tested at least every quarter. This sampling programme can be adjusted to reflect the production cycle. Conduct additional product testing if there are new products or equipment introduced or when there has been a contamination event and *Listeria* has been found in product or on product contact surfaces. Consider testing three batches of product processed over consecutive processing days to provide some assurance that the process is under control.

It is also recommended that extra sampling of both product and the environment is done during peak production times. While this may be seen as an unwelcome extra task at a busy time, the additional pressure placed on the process controls means more checking that the controls are working is needed to safeguard production and avoid costly recalls.

6.6 Contracting a laboratory to do the testing

You will need to have a contract with a laboratory that will do the tests for you. For operators under certain regulatory regimes there may be a requirement to use a laboratory that has IANZ accreditation for *Listeria* testing. IANZ website is available at: www.ianz.govt.nz

The laboratory will need to know when sampling will take place so that they can plan the testing. In addition the laboratory may be able to supply you with the equipment such as swabs needed to take samples and provide instructions on how to transport the samples chilled. The time between collecting the samples and testing should be as short as possible, ideally around 24 hours.

6.7 Sampler training

You will need to have staff trained to take swabs and product samples according to the plan you have written down.

6.8 Review the results

When results come back they need to be looked at immediately and responded to if necessary. Keep all the laboratory reports together and look for trends.

If *Listeria* spp. or *L.monocytogenes is* detected take corrective and preventative actions to prevent reoccurrence. This may include repairs and maintenance, intensive cleaning and sanitation or replacing worn equipment that is a contamination source.

If *Listeria monocytogenes* is detected in product that is available for sale you will need to consider whether a recall (trade or consumer) should occur. For further information refer to Part 4.

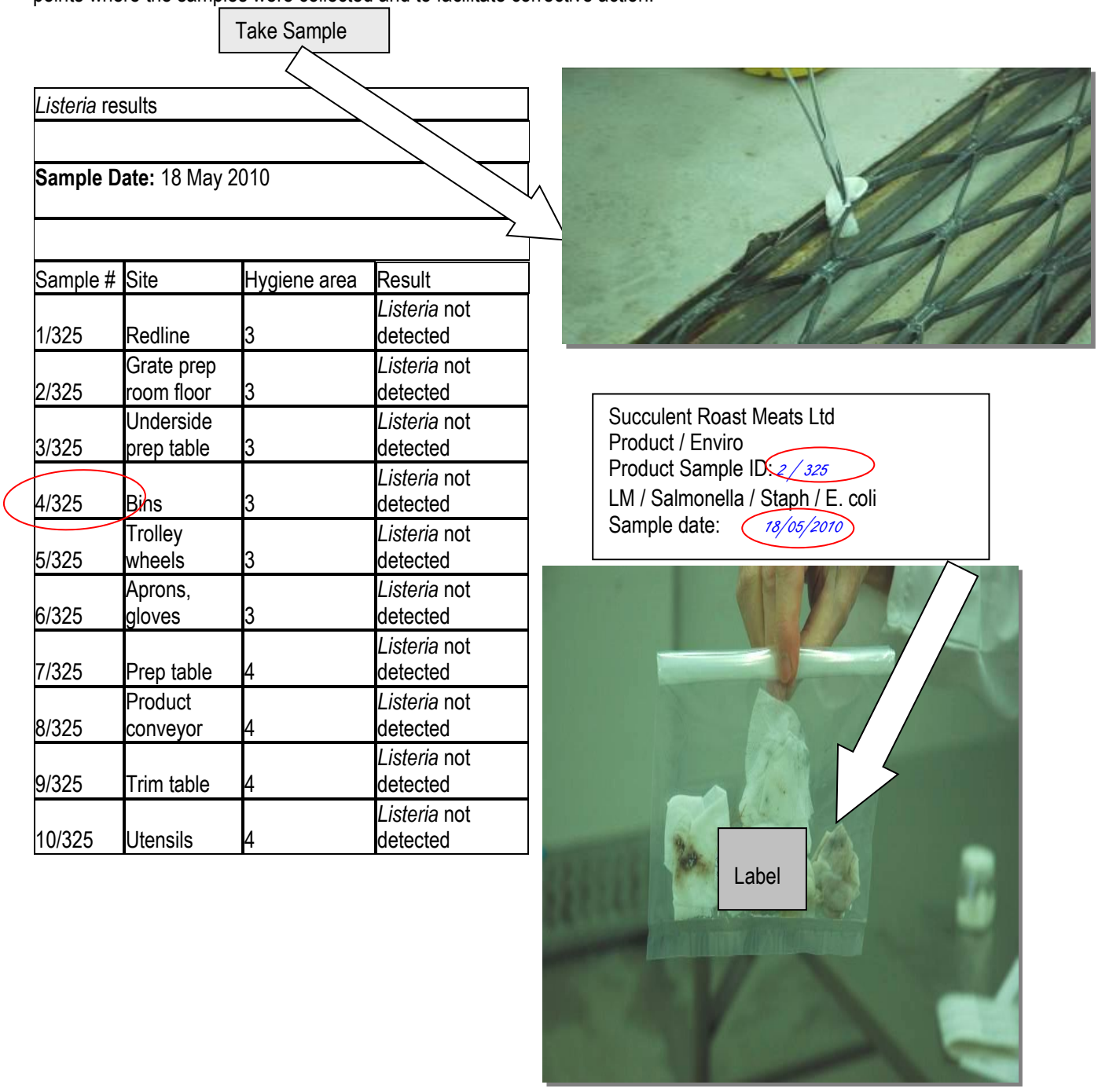
Appendix 2: Sample labelling and traceability

Samples should be clearly labelled and sufficient information recorded to ensure easy traceability to the batch, site or item sampled.

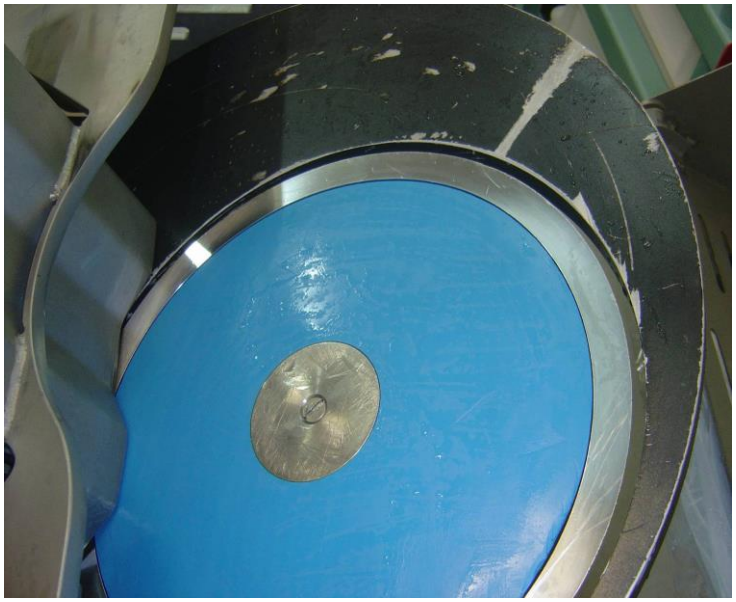
The following figure provides an example of this. The label states:

- the company name;
- sample type;
- sample identification;
- test required and date;
- the sample number then links directly to the record sheet with the results.

In the event of *L. monocytogenes* being detected it would be possible to trace the contamination back to the points where the samples were collected and to facilitate corrective action.



Appendix 3: Examples of potential niches




Cuts in the nylon belt rollers


FOOT